

Recreational Use Attainability Analysis for Buffalo Creek (0214B), Paradise Creek (0230A), and Sweetwater Creek (0299A) in the Red River Basin

DRAFT for PUBLIC REVIEW

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CHAPTER 1

INTRODUCTION

Problem Statement

Buffalo Creek (0214B), Paradise Creek (0230A), and Sweetwater Creek (0299A) are unclassified water bodies located in primarily rural watersheds located within the Red River Basin (Table 1.1 and Figure 1.1). These watersheds have been listed on consecutive Texas 303(d) lists for being impaired for bacteria (TCEQ, 2013).

- Buffalo Creek (0214B) flows east from Electra to its confluence with the Wichita River south of Iowa Park. The watershed is contained entirely within Wichita County, and includes portions of the cities of Electra and Iowa Park. Buffalo Creek was first listed as impaired for bacteria in 2010 (TCEQ, 2013). Additional concerns along Buffalo Creek include ammonia, chlorophyll-a, nitrate, orthophosphorus, and total phosphorus.
- Paradise Creek (0230A) flows from the eastern portion of Foard County to its confluence with the Pease River just east of Vernon in Wilbarger County. The watershed encompasses the City of Thalia and portions of Vernon. Paradise Creek was first listed for bacteria in 2006 (TCEQ, 2013). Additional concerns along Paradise Creek include chlorophyll-a and nitrate.
- Sweetwater Creek (0299A) forms in Gray County and flows through Wheeler County where it is truncated at the Texas-Oklahoma border. The Sweetwater Creek watershed encompasses the cities of Mobeetie and Wheeler. Sweetwater Creek was first listed for bacteria in 2002. No other parameters are noted as impairments or concerns for Sweetwater Creek.

These unclassified water bodies have a presumed use of primary contact recreation based on the *Texas Surface Water Quality Standards* (TSWQS) (TCEQ, 2010). Prior to June 2010 only two categories of recreation use, contact and noncontact, existed in Texas. In June 2010, the TCEQ adopted revisions to the TSWQS that expanded the designation of contact recreation into three categories (primary contact recreation, secondary contact recreation 1, and secondary contact recreation 2) based on varying degrees of interaction with the water, while maintaining a fourth category of noncontact recreation. These revisions were codified in the Texas Administrative Code (TAC), Title 30 Chapter 307 and became effective as a state rule on July 22, 2010 (TCEQ, 2010). As a result of these revisions to the TSWQS, all water bodies listed as impaired based on bacteria for contact recreation are scheduled to undergo a standards review to determine if primary contact recreation is appropriate or if a revision to that use category for recreation should be considered for the water body.

Table 1.1 Water bodies targeted for RUAA's

TCEQ ID	Water Body Name	TCEQ 303(d) List Description	Stream Type	Listed Assessment Miles	Watershed Area (Acres)
0214B	Buffalo Creek	From the confluence of the Wichita River west of Wichita Falls in Wichita County to the upstream perennial portion of the stream east of Electra in Wichita County	Intermittent with pools	33.7	64,975
0230A	Paradise Creek	From the confluence with the Pease River east of Vernon to the upstream perennial portion near Thalia in Foard County	Intermittent with pools	45.4	72,190
0299A	Sweetwater Creek	From the Oklahoma State Line in Wheeler County to the upstream perennial portion of the stream northwest of Wheeler in Wheeler County (tributary of North Fork Red River)	Perennial	68.9	242,655

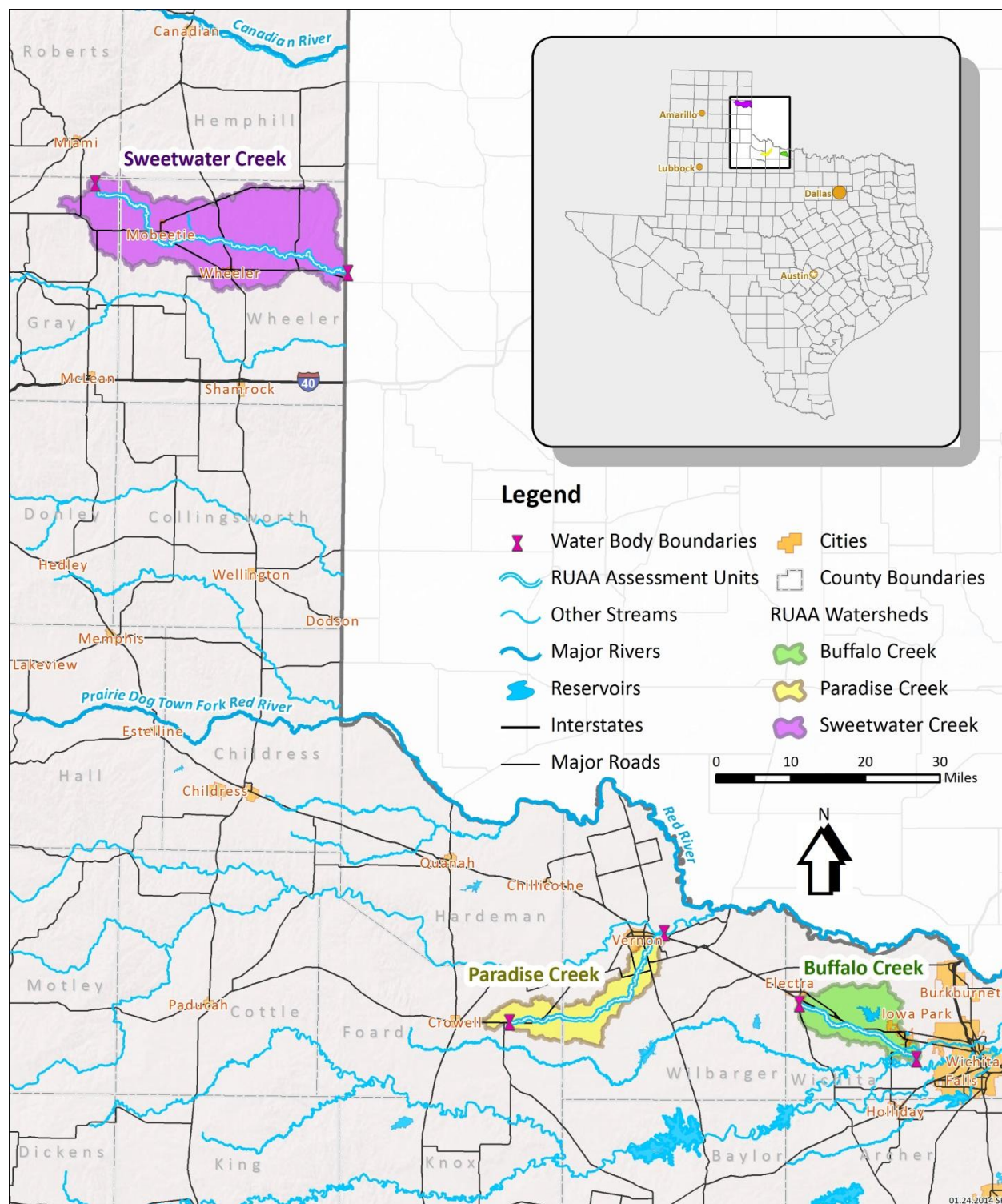


Figure 1.1 Map showing location of Sweetwater, Paradise, and Buffalo Creek watersheds.

Use attainability analyses (UAAs) are studies to evaluate the designated or presumed uses of a water body. To identify and assign attainable uses and criteria to individual waterbodies, UAAs evaluate physical, chemical, biological, and economic factors affecting use attainment of a

waterbody (40 Code of Federal Regulations §131.10(g)). A recreational use attainability analysis (RUAA) is a specific type of UAA focused on determining the appropriate recreational use category of a waterbody, the findings of which are presented within this report for Buffalo Creek (0214B), Paradise Creek (0230A), and Sweetwater Creek (0299A).

The objective of this report is to present the findings of a Comprehensive RUAA for Buffalo Creek, Paradise Creek, and Sweetwater Creek following the Texas Commission on Environmental Quality (TCEQ) February 2012 *Procedures for a Comprehensive RUAA and a Basic RUAA Survey* (TCEQ, 2012). An RUAA consists of three parts: field surveys to document waterbody characteristics and signs of recreation, interviews with stakeholders regarding past and current use of the waterbody, and a historical review regarding recreational use of the waterbody. All components of this RUAA were performed by Texas Institute for Applied Environmental Research (TIAER), which is located on the campus of Tarleton State University in Stephenville, Texas. Field surveys and interviews for the RUAA were conducted under a Texas State Soil and Water Conservation Board (TSSWCB) approved Quality Assurance Project Plan (QAPP; TIAER, 2013).

Stakeholder and Agency Involvement

The TSSWCB and its collaborating entities maintain an inclusive public participation process. From the inception of this project, the project team sought to ensure that stakeholders were informed and involved.

Input from the Red River Authority (RRA), Clean Rivers Program (CRP), Texas Parks and Wildlife Department regional staff, TCEQ regional staff, local Soil and Water Conservation Districts (SWCD), and other local agencies was solicited in addition to watershed stakeholder's input about the need for the RUAA (see Contact Information Forms available on the project website noted below.) Stakeholder involvement is recognized as the key source of knowledge about each water body. Furthermore, it can facilitate in the site selection process.

Meetings with state agencies, river authority representatives, local officials, and stakeholders were held to give an overview of water quality issues within each of the three watersheds. At these meetings, attendees were given an opportunity to comment on proposed study sites prior to field data collection. These public meetings were used to solicit input from all interested parties within the study area. Dates, locations, and local officials that were met with can be seen below on Table 1.2.

Table 1.2 RUAA introductory meeting dates and locations

	Local Officials	Meeting Dates	Meeting Location
Buffalo Creek	Iowa Park City Council	January 28, 2013	Iowa Park, TX
	Wichita County Commissioners	February 4, 2013	Wichita Falls, TX
	Electra City Council	February 12, 2013	Electra, TX
	Wichita SWCD	March 6, 2013	Iowa Park, TX
Paradise Creek	Wilbarger County Commissioners	January 28, 2013	Vernon, TX
	Foard County Commissioners	January 28, 2013	Crowell, TX
	Wilbarger SWCD	February 5, 2013	Vernon, TX
	Foard SWCD	February 14, 2013	Crowell, TX
	Crowell City Council	February 19, 2013	Crowell, TX
Sweetwater Creek	Mobeetie City Council	January 14, 2013	Mobeetie, TX
	Gray County Commissioners	February 1, 2013	Pampa, TX
	Wheeler City Council	February 18, 2013	Wheeler, TX
	Wheeler County Commissioners	March 11, 2013	Wheeler, TX
	Gray SWCD	March 21, 2013	Pampa, TX

The first public meetings targeted landowners in each watershed in an effort to inform them of the water quality impairments in the watersheds and the need for an RUAA. The first meetings were held in Iowa Park, TX for Buffalo Creek, Vernon, TX for Paradise Creek, and Wheeler, TX for Sweetwater Creek. The meeting dates were held on the 17th, 18th, and 15th of April, 2013 respectively. At these meetings, stakeholder input was sought concerning locations for potential survey sites as each stream was largely accessible only via private property with public access limited mainly to road crossings. Stakeholders posed several questions regarding how recreational use could be assessed given current dry conditions. The importance of interviews in providing feedback on past recreational use was emphasized by TIAER and the TSSWCB. Interview forms were made available at these meetings. TIAER solicited interviews from watershed stakeholders. While interviews were obtained from a number of individuals within the watershed, landowners with riverfront property were specifically targeted for interviews at the meeting and also via direct phone calls.

Progress update meetings were held to provide a summary of activities conducted to date on the RUAA's conducted on Buffalo, Paradise, and Sweetwater. This meeting was held to discuss findings from the initial RUAA field survey completed in May 2012.

A final stakeholder meeting will occur in each watershed, during which the findings of field surveys, the historical review, and interviews will be presented. The next steps of the RUAA will also be discussed at this meeting and feedback from stakeholders will be solicited. At the meeting, stakeholders will be informed of the availability of the draft RUAA report for public review and comment. The draft report will be made available via the project website and TIAER will provide hard copies to individuals if desired.

Watershed stakeholders were invited to attend the public meetings through mailed invitations, public announcements, TSSWCB webpages, and individual phone calls. Information on past

meetings, including agendas, presentations, and other information can be found at the websites provided below:

<http://www.tsswcb.texas.gov/en/managementprogram/ruaasweetwater>

<http://www.tsswcb.texas.gov/en/managementprogram/ruaaparadise>

<http://www.tsswcb.texas.gov/en/managementprogram/ruaabuffalo>

Chapter 2

Study Methodology

The process of developing a survey site list began by using a combination of Geographic Information System (GIS) data, review of historical information, meetings and phone conversations with local entities, and field reconnaissance.

Site Reconnaissance and Site Selection Strategy

The site reconnaissance was conducted prior to performing field survey activities. The reconnaissance had the purpose of collecting background information and selecting appropriate sites for the field survey. To the degree possible, site reconnaissance was coordinated with watershed stakeholders in an effort to increase local landowner interest in water quality issues. A goal of the site reconnaissance based on the February 2012 RUAA procedures (TCEQ, 2012), was to, if possible, locate three sites per every five miles of stream. Based on this recommendation, the ideal number of sites was 21 for Buffalo Creek, 28 for Paradise Creek, and 42 for Sweetwater Creek.

The following information was compiled using Geographic Information System (GIS) based tools prior to, during, and immediately following the site reconnaissance:

- The location of areas along the water body that were accessible to the public and had the highest potential for recreational use, such as road crossings and parks;
- The location of permitted wastewater outfalls and other potential point sources;
- The hydrologic characteristics, such as stream type, streamflow, and hydrologic alterations; and
- The location of city boundaries or other designated population areas.

The site selection process took into account locations that were accessible to the public, had the highest potential for recreational use, and had TCEQ monitoring stations where historical data may have been previously collected. The site selection process also considered parks and bridge crossings along the river, as well as access through private lands adjacent to the river. Public access to the three creeks was limited except at state and county road crossings. In many instances, fences abutted the bridge; preventing easy public access to the creek. However, many fences did not abut the bridge and allowed public access directly beneath the bridge. A few road crossings had no fence at all. If landowner permission to access the creek via private property on either side of the road was not granted, and the 300 meters required for the RUAA field survey could not be obtained, the site was excluded from the RUAA field survey. For road crossings that could not be included as a formal survey sites, observations were recorded from the bridge during both surveys.

Sampling Methods

Field Survey Data Collection Activities

As specified in the procedures for a Comprehensive RUAA (TCEQ, 2012), two separate field surveys occurred during the warm season (air temperature greater than or equal to 70°F or 21°C) when human recreational activities were most likely to occur (May - September). Ideally, field surveys were to be conducted when stream flow conditions were normal. However, due to extended extreme drought conditions, low flow conditions were encountered during the survey. Many of the stream sites were dry as the drought conditions continued through the summer of 2013. Rainfall records 30 days prior to each survey were also recorded to present antecedent conditions.

Data collection activities for each of the two field surveys included the following activities at each RUAA site:

- Measurement of average depth at thalweg (deepest depth),
- Measurement of depths, lengths, and widths of substantial pools,
- Reporting of observational/anecdotal data required on the RUAA field forms,
- Photographing any signs of recreation and site conditions including upstream, downstream, left bank, and right bank photos at the 30-m, 150-m, and 300-m transects.

Average Depth at Thalweg and Substantial Pool Depths

Determination of thalweg and substantial pool depths is applicable to contact recreation use determination for intermittent and perennial freshwaters according to TCEQ (2012). The thalweg is defined as the deepest depth of a transect perpendicular to the stream channel. A substantial pool was defined as a pool greater than 1-m (3.28-ft) deep and 10-m (32.8-ft) long for the purposes of a RUAA Survey (TCEQ, 2012).

As instructed in the RUAA procedures manual (TCEQ, 2012), a 300-m reach at each station was evaluated to determine average thalweg depth. Eleven transects at 30-m intervals were established in the 300-m stream reach bracketing each station. Each reach surveyed was oriented downstream to up, the 0-m transect was always set as the most downstream and the 300-m transect as the most upstream. All transect distances including thalweg depths and pool depths and lengths are presented in units of meters per the RUAA procedures (TCEQ, 2012).

Observational /Anecdotal Data

Anecdotal information was recorded on field data sheets during all surveys using the field data sheets from the TSSWCB-approved QAPP (TIAER, 2013).

Types of observational and anecdotal records included, but were not limited to, the following:

- Channel flow status as indicated by flow severity
- Stream type (e.g., ephemeral, intermittent, etc.)
- Streamflow

- General weather conditions (cloud cover/rain), including 30-day conditions and antecedent rainfall record
- Substrate type
- Stream accessibility
- Anecdotal information related to observed human contact activities

Photographs

TIAER staff created photographic records of each site during the site surveys. Photographs included an upstream view, left and right bank views, downstream view (as described in the Field Data Sheets), and any evidence of observed uses or indications of human use, hydrologic modifications, etc. Photographs were intended to clearly depict the entire channel and were taken specifically at the 30-m, 150-m, and 300-m transects for the reach. Any items of interest, e.g., obstructions, were also photographed. Photographs were used to document evidence of recreational use (e.g., fishing tackle) and actual recreation. Photographs were also used to document a lack of use (e.g., dry creek beds) or impediments to recreational use. In addition as part of the overall project, photographs were also taken to indicate potential bacteria sources to the waterbody. All photographs were labeled in a manner that indicated the photo's subject, site location, date, and orientation to the stream. Selected photos representative of each RUAA field site are included with the survey results for each water body in this report. All photos are provided electronically on the TSSWCB website for each individual watershed:

<http://www.tsswcb.texas.gov/en/managementprogram/ruaasweetwater>

<http://www.tsswcb.texas.gov/en/managementprogram/ruaaparadise>

<http://www.tsswcb.texas.gov/en/managementprogram/ruaabuffalo>

Chapter 3

Buffalo Creek

(0214B)

Watershed Characteristics

The Buffalo Creek watershed covers 64,975 acres and includes portions of the cities of Electra (estimated population 2,772) and Iowa Park (estimated population 6,312). The North Fork Buffalo Creek Reservoir and Lake Iowa Park are located within the watershed (Figure 3.1); however, neither of these impoundments are located along the main assessment unit where the RUAA surveys occurred. The watershed overlays a portion of the Seymour Aquifer (George, et al., 2011). The terrain is flat with clay and sandy loams as the dominate soil types (TSHA, 2013a).

The Buffalo Creek watershed lies within the Broken Red Plains ecoregion (27i) (Griffith, et al., 2007) and is primarily used for grazing and oil and gas production. Average rainfall for the region ranges from 26 to 32 inches annually. Mean minimum and maximum temperatures for the region range from 28 to 54°F in January and 71 to 96°F for July. The watershed is primarily rural with grassland representing over 50 percent of the land area and cultivated cropland just over 30 percent of the land area (Figure 3.2). Along the riparian areas, woody vegetation is dominant and woody vegetation prevalent within the Broken Red Plains ecoregion includes honey mesquite (*Prosopis glandulosa*), cottonwood (*Populus* spp.), hackberry (*Celtis* spp.), cedar elm (*Ulmus crassifolia*), pecan (*Carya illinoensis*), and little walnut (*Juglans microcarpa*) (Griffith, 2007).

Uses, Impairments and Concerns

Buffalo Creek is classified as intermittent with pools (TCEQ, 2013) and has presumed uses of primary contact recreation, general use, and fish consumption with limited aquatic life use. Buffalo Creek was first listed impaired for bacteria on the 2010 Texas 303(d) list. Parameters of concern include ammonia, chlorophyll-a, nitrate, orthophosphorus, and total phosphorus.

Permitted Discharges

There are two permitted wastewater treatment facilities (WWTFs) within the Buffalo Creek watershed, the City of Electra WWTF and the City of Iowa Park WWTF. The City of Electra WWTF (TX0026964) is located immediately south of State Loop 477 and west of Midway Church Rd. It has one outfall that discharges into the south fork of Buffalo Creek. The Electra WWTF is a pond system with three lagoons. The facility has a maximum allowable daily discharge rate of 0.64 million gallons per day (MGD) (Macias, 2013). However, due to high evaporation rates, average daily discharge records between 2007 and 2011 ranged from 0.00 to 0.27 MGD (EPA, 2013). The most recent permit for the City of Electra issued on September 8, 2010, indicates a bacteria discharge limit of 126 cfu or MPN/100 mL.

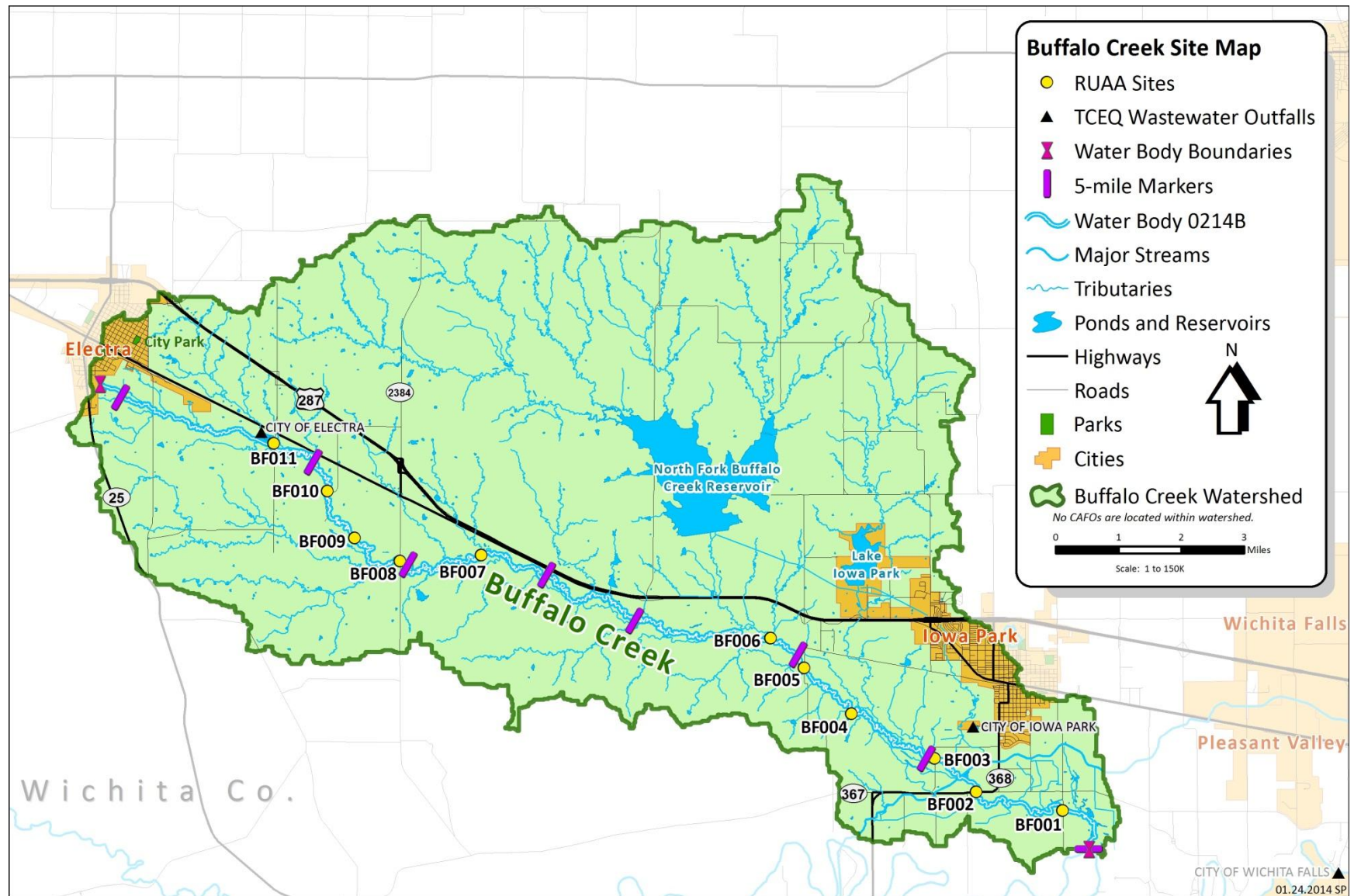


Figure 3.1 Overview of Buffalo Creek watershed and RUAA sites.

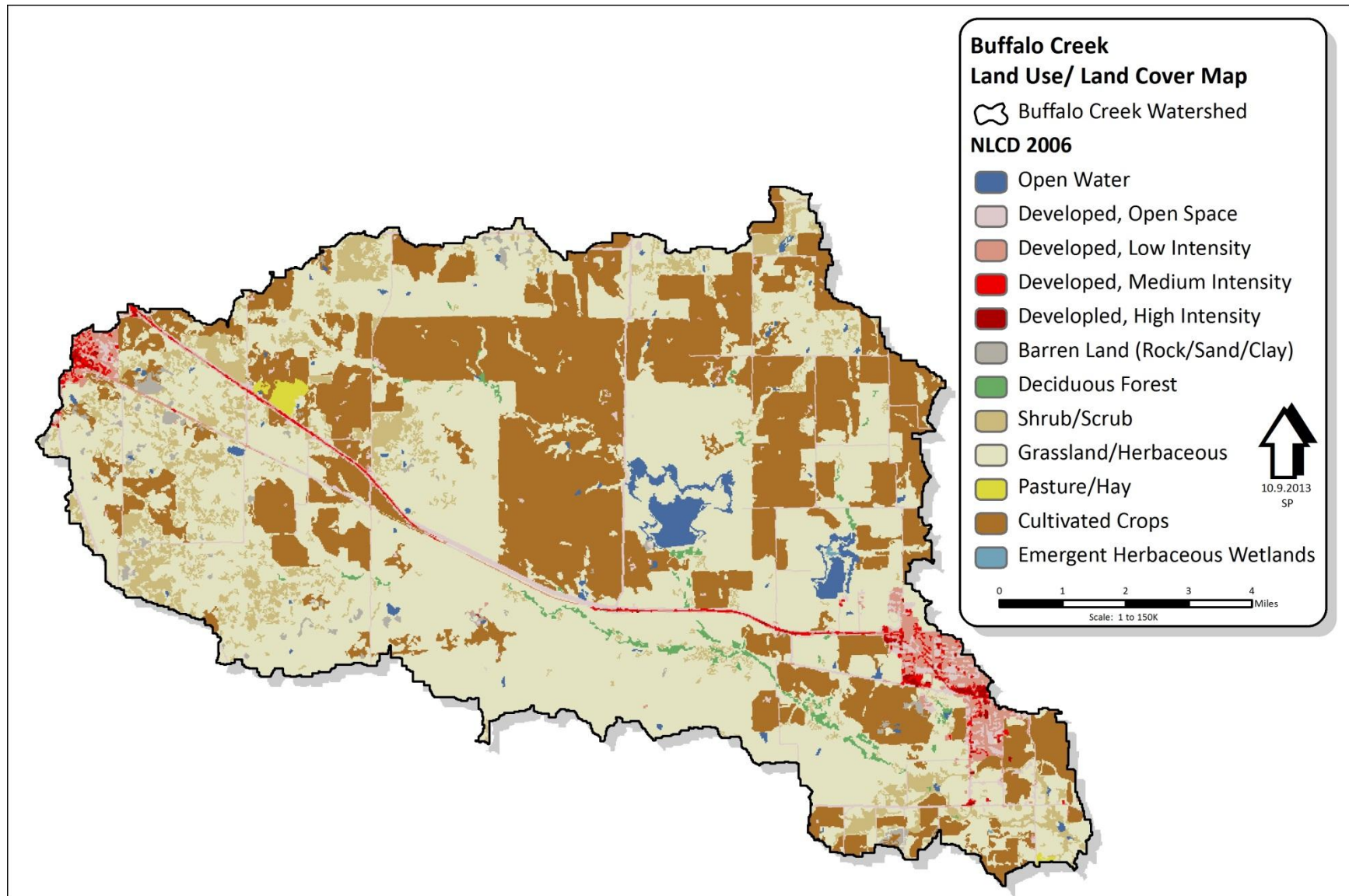


Figure 3.2 Land use/land cover for the Buffalo Creek watershed. Source: 2006 National Land Cover Database (USGS, 2013).

A violations review for the Electra WWTF indicated the following: Five-day biological oxygen demand (BOD₅) exceeded maximum and average effluent limitations on September 2009, February 2010, December 2011, February 2012, March 2012, and March 2013. *E. coli* exceeded maximum and average effluent limitations on October 2010, and total suspended solids (TSS) exceeded average effluent limitations on May 2012 and March 2013.

The City of Iowa Park WWTF (TX0052922) is located on W Chestnut St 0.25 mi west of FM 368 and 1 mi north of FM 367. The facility has a tertiary treatment system with an aeration basin, clarifier, and contact chamber. Biosolids are disposed of at the landfill near Iowa Park. Effluent is discharged into an earthen canal that flows into Buffalo Creek between Coleman Park Rd and FM 367. Average daily discharge is not to exceed 1 MGD or an average of 1,292 gallons per minute (gpm) over a 2 hour peak (Macias, 2013). With the exception of 2009, average daily flow between 2007 and 2011 ranged from 0.46 to 0.73 MGD (EPA, 2013). Effluent limitations for *E. coli* are set at a daily average of 126 CFU/100ml or a daily maximum of 394 CFU/100ml for single samples (Macias, 2013). Between July 2009 and March 2013, the City of Iowa Park WWTF has had three incidences of *E. coli* exceeding effluent limitations: October 2011, June 2012, and February 2013 (EPA, 2013). Total residual chlorine fell below minimum effluent limitations in April 2010, and pH fell below minimum requirements in May 2011 and February 2013.

There are currently no permitted concentrated animal feeding operations within the Buffalo Creek watershed.

Non-Permitted Agricultural Activities and Domesticated Animals

Activities such as livestock grazing close to waterbodies and agricultural use of manure as fertilizer, can contribute *E. coli* to nearby waterbodies. Livestock statistics were obtained from United States Department of Agriculture (USDA) National Agricultural Statistics Service website from the 2007 survey (USDA, 2007). These statistics indicated large numbers of beef cattle in Wichita County.

Table 3.1 Estimated livestock numbers within the Buffalo Creek watershed based on statistics for Wichita County adjusted for the percent of the county within the watershed. (Source USDA, 2007).

County	Year	Cattle & Calves (all beef)	All Goats	Mules, Burros, and Donkeys	Horses & ponies
Wichita	2007	38,705	1,703	357	1,789
Buffalo Creek Watershed Average	2007	6,348	279	58	293

Domestic pets are another unregulated source of *E. coli* bacteria, particularly dogs, because storm runoff often carries these wastes into streams (EPA, 2009). Assuming a rough estimate of 0.584 dogs per household (AVMA, 2012) and about 3,000 households within the Buffalo Creek watershed based on 2010 census population data (about 7,000 individuals and 2 individuals per

household), there are potentially about 1,752 dogs within the Buffalo Creek watershed. Other domestic animals, such as outdoor cats, can also contribute to bacterial pollution; however, cat populations are difficult to estimate because in many rural areas, cats are often feral.

Wildlife and Feral Hogs

E. coli inhabit the intestines of warm-blooded animals including wildlife such as deer, feral hogs, and birds. Animal waste may enter a waterbody via direct deposition or by washing into a nearby waterbody after a rainfall event. Between 2005 and 2012, average estimated whitetail deer densities ranged between 5.83 to 28.9 deer/1000 acres within the regional management units encompassing the Buffalo Creek watershed (TPWD, 2012). Feral hogs are an invasive species commonly found throughout Texas. They have been known to travel in large groups along waterways and congregate near shallow depressions of water. Statewide feral hog densities range from an estimated average of 1.33 to 2.45 hogs per square mile (Agrilife, 2011).

Failing On-Site Sewage Facilities

Septic systems of on-site sewage facilities (OSSFs) are often used in rural areas that do not have the ability to connect to a central wastewater collection system. The U.S. Census Bureau (USCB) data indicate that of the 3,000 households in the Buffalo Creek watershed, only about 13 percent are outside municipal areas and likely on septic systems.

Historical Review

A review of historical information regarding recreational use of Buffalo Creek was conducted. The review considered the time period of November 28, 1975 to the present in accordance with 40 CFR Part 131 (EPA standards regulation). Government offices, libraries, historical societies, and newspapers were searched and contacted in addition to generic internet searches. The following is a summary of the review.

Government Sources

City of Iowa Park

<http://www.iowapark.com/>

Only significant information found pertained to drought conditions. No article referenced Buffalo Creek

City of Electra

<http://www.cityofelectra.com/>

Nothing of significance was found pertaining to the historical use of Buffalo Creek

Library Sources

Electra Library

<http://www.cityofelectra.com/departments/library.php>

Phone: (940) 495-2208

Explored various links and online texts. Nothing significant was found.

Tom Burnett Memorial Library

<http://www.iowapark.com/dept/library/43/>

Phone: (940) 592-4981

Explored various links and online texts. Nothing significant was found.

Newspaper Sources

Time Record News

<http://www.timesrecordnews.com/>

Phone: (940) 767-8341

Nothing significant was found.

Internet Searches

The Handbook of Texas Online

<http://www.tshaonline.org/>

Searched the handbook by creek name. Nothing was found.

Survey Site Descriptions

Eleven sampling sites were located along Buffalo Creek, 0214B (Figure 3.1 and Table 3.2). Twenty-one sampling sites were preferred according to research guidelines. All access to Buffalo Creek is privately owned except narrow access points at public road crossings and those are all delimited by fences. For Buffalo Creek, all road crossings were included as RUAA sites except for the Jennings Road crossing. Landowner permission could not be obtained at this location. Almost half of the total land adjacent to Buffalo Creek was owned by a single company. Because property access was not granted, only 11 of the 21 recommended survey sites were obtained for Buffalo Creek.

Six sites were at public road crossings where landowner permission was not required to access the stream; however, landowner permission was required, and attained, on these sites to conduct the entire 300-m survey. The other five sites are located on private property where access is restricted

by fences, locked gates, long distances from public roads and/or required a landowner escort. The RUAA surveys were conducted at these locations in June and July of 2013. Sites were selected based on appropriate representation of Buffalo Creek and on landowner cooperation. All sites are located in Wichita County between Electra and southeast of Iowa Park.

Table 3.2 Description and location of RUAA field survey sites for Buffalo Creek (0214B).

* indicates that the site was publically accessible at a road crossing but that further access was limited by fencing of private property.

TCEQ ID	Site ID	Site Description	Latitude	Longitude	Distance from Previous Site (mi)¹	Distance from Confluence (mi)¹	Distance from Upper Reach (mi)¹	Access
10097	BF001	Buffalo Creek at Bell Rd south of Iowa Park, east of road	33.921748	-98.654205	-	1.18	33.94	Public*
	BF002	Buffalo Creek at FM 367 south of Iowa Park, south of road	33.926077	-98.678127	2.37	3.55	31.57	Public*
16036	BF003	Buffalo Creek at Coleman Park Rd south of Iowa Park, east of road	33.933848	-98.689599	1.19	4.74	30.38	Public*
	BF004	Buffalo Creek 1.83 river miles east of Old Electra Rd	33.944218	-98.712534	2.86	7.60	27.52	Private
	BF005	Buffalo Creek at Old Electra Rd southwest of Iowa Park, east of road	33.954803	-98.725636	1.83	9.43	25.69	Public*
	BF006	Buffalo Creek 1.06 river miles west of Old Electra Rd, near railroad	33.961670	-98.734895	1.06	10.49	24.63	Private
	BF007	Buffalo Creek 3.47 river miles east of FM 2384	33.980992	-98.814977	10.87	21.36	13.76	Private
	BF008	Buffalo Creek at FM 2384, west of road	33.979637	-98.837430	3.47	24.83	10.29	Public*
	BF009	Buffalo Creek 2.02 river miles west of FM 2384	33.985000	-98.849970	2.02	26.85	8.27	Private
	BF010	Buffalo Creek at Old Gun Club Rd southeast of Electra	33.995800	-98.857500	1.61	28.46	6.66	Private
	BF011	Buffalo Creek at Midway Church Rd southeast of Electra WWTF, east of road	34.006860	-98.872330	2.56	31.02	4.10	Public*

¹Distances were digitally estimated using the measuring tool in ArcGIS 9.3 with the 2010 NAIP 1-m DOQQs and the NHD stream layer as reference guides.

Site BF001 is the most downstream site located on Buffalo Creek 1.18 miles from the confluence with the Wichita River where FM 1814 crosses the creek. This site is publically accessible at the bridge only with a private property fence restricting further access. Landowner permission allowing across-fence access away from the road crossing was required to complete the survey.

Site BF002 is located on Buffalo Creek 3.55 miles from the confluence with the Wichita River where FM 367 crosses the creek. This site is publically accessible at the bridge only with a private property fence restricting further access. Landowner permission allowing across-fence access away from the road crossing was required to complete the survey.

Site BF003 is located on Buffalo Creek 4.74 miles from the confluence with the Wichita River at Coleman Park Road. This site is publically accessible at the bridge only with a private property fence restricting further access. Landowner permission allowing across-fence access away from the road crossing was required to complete the survey.

Site BF004 is located on Buffalo Creek 7.6 miles from the confluence with the Wichita River at Old Electra Road. Access to this site required landowner escort through a locked gate and approximately 1 mile on private dirt road.

Site BF005 is located on Buffalo Creek 9.43 miles from the confluence with the Wichita River at Old Electra Road. This site is publically accessible at the bridge only with a private property fence restricting further access. Landowner permission allowing across-fence access away from the road crossing was required to complete the survey.

Site BF006 is located on Buffalo Creek 10.49 miles from the confluence with the Wichita River. Access to this site required landowner escort through private property gate approximately 0.5 mile on dirt road from access road 287.

Site BF007 is located on Buffalo Creek 21.36 miles from the confluence with the Wichita River on private property. Access to this site required landowner escort through a locked gate approximately .25 mile on a dirt road.

Site BF008 is located on Buffalo Creek 24.83 miles from the confluence with the Wichita River. This site is publically accessible at the bridge only with a private property fence restricting further access. Landowner permission allowing across-fence access away from the road crossing was required to complete the survey.

Site BF009 is located on Buffalo Creek 26.85 miles from the confluence with the Wichita River. Access to this site required landowner permission, passing through a gate and cattle guard onto fenced private property and continuing approximately 1 mile on a private dirt road.

Site BF010 is located on Buffalo Creek 28.46 miles from the confluence with the Wichita River at Old Gun Club Road. Access to this site require landowner permission, passage through a gate and cattle guard onto fenced private property and continuing approximately .5 mile on private dirt road.

Site BF011 is located on Buffalo Creek 31.02 miles from the confluence with the Wichita River at Midway Church Road. The creek is accessible from the road crossing however approximately

10m from the bridge, passage through a fence onto private property was required to conduct the survey.

Field Survey Results and Discussions

General Description of RUAA Survey Sites and Conditions for Buffalo Creek (0214B)

The Buffalo Creek RUAA surveys were conducted on June 8 and 14, 2013 and July 20, 2013. The surveys were performed on weekdays, weekends, or holidays at opportune times to observe recreational activities along Buffalo Creek. Air temperatures prior and during both the first and second surveys were above 21°C (70°F) indicated by the RUAA guidelines as warm enough to promote recreational activities (Tables 3.3 and 3.4). About two inches of precipitation fell in the 30 days prior to each survey, although notably warmer temperatures occurred in July than in June.

Table 3.3 Rainfall records with maximum and minimum temperature for Iowa Park, Texas 30 days prior to the first RUAA survey initiated on June 8, 2013.

Survey dates are shaded in grey. Data obtained from Weather Underground for Iowa Park weather station KSPS, KTXIOWAP2.

Date	Daily Precipitation (in)	Maximum Daily Temperature (°F)	Minimum Daily Temperature (°F)
09-May-13	0	82	63
10-May-13	0	81	56
11-May-13	0	88	47
12-May-13	0	85	46
13-May-13	0	95	58
14-May-13	0	93	60
16-May-13	0.01	87	60
17-May-13	0	102	67
18-May-13	0	102	71
19-May-13	0	105	74
20-May-13	0.02	97	70
21-May-13	0.51	81	57
22-May-13	0	91	53
23-May-13	0.09	91	64
24-May-13	0	91	67
25-May-13	0.02	84	66
26-May-13	0	92	70
27-May-13	0	91	72

Date	Daily Precipitation (in)	Maximum Daily Temperature (°F)	Minimum Daily Temperature (°F)
28-May-13	0	81	75
29-May-13	0	88	73
30-May-13	0.02	96	75
31-May-13	0	103	76
1-Jun-13	0	91	66
2-Jun-13	0	89	58
3-Jun-13	0	96	64
4-Jun-13	0.02	100	69
5-Jun-13	0	93	74
6-Jun-13	1.14	80	65
7-Jun-13	0	no data	no data
8-Jun-13	0.01	91	77
9-Jun-13	0	101	65
10-Jun-13	0	100	69
11-Jun-13	0	99	64
12-Jun-13	0	99	76
13-Jun-13	0	100	74
14-Jun-13	0	98	71

Table 3.4 Rainfall records with maximum and minimum temperature for Iowa Park, Texas 30 days prior to the second RUAA survey initiated on July 20, 2013.

The survey date is shaded in grey. Data obtained from the Weather Underground for Iowa Park weather station KSPS, KTXIOWAP2.

Date	Daily Precipitation (in)	Maximum Daily Temperature (°F)	Minimum Daily Temperature (°F)
22-Jun-13	0	99	75
23-Jun-13	0	100	76
24-Jun-13	0	98	76
25-Jun-13	0	101	78
26-Jun-13	0	104	79
27-Jun-13	0	107	75
28-Jun-13	0	106	77
29-Jun-13	0	101	70
30-Jun-13	0.01	96	69
1-Jul-13	0	90	64
2-Jul-13	0	92	59
3-Jul-13	0	92	58
4-Jul-13	0	99	66
5-Jul-13	0	102	69
6-Jul-13	0	102	73
7-Jul-13	0	102	75
8-Jul-13	0	103	75
9-Jul-13	0	102	77
10-Jul-13	0	102	88
11-Jul-13	0	108	77
12-Jul-13	0	106	73
13-Jul-13	0	108	78
14-Jul-13	0.51	88	66
15-Jul-13	0.32	71	64
16-Jul-13	0.94	82	69
17-Jul-13	0.21	89	70
18-Jul-13	0	93	68
19-Jul-13	0	98	69
20-Jul-13	0.27	99	72

A summary of the RUAA field survey results is presented in the following tables:

- Table 3.5 describes the stream channel and corridor characteristics at each site.
- Table 3.6 notes the average thalweg depth by site during each survey and the access to the stream, whether public or private, and the ease of bank access.
- Tables 3.7 and 3.8 document the maximum, minimum, and average stream widths at each site for each survey and observed flow conditions.
- Tables 3.9 and 3.10 note stream aesthetics, wildlife observations and tracks, and the presence of garbage observed at each site during each survey.

Physical descriptions of each site follow these tables along with selected photos showing notable characteristics of each site. Overall thalweg depth averaged 0.19 m during the first survey and 0.09 m during the second survey. Access to the stream down the bank was moderately difficult in most locations due to dense vegetation and steep banks. The dominant substrate was mud/clay and the stream corridor was largely lined with trees and shrubs. The maximum stream width encountered was 10 m during the first survey in June 2013 and 5.4 m during the second survey in July. Flow conditions were low to normal in June but no flow was noted at most survey sites in July. In general, the majority of observed tracks and fecal droppings reported in the tables are from wildlife. The water surface was generally clear and varied in color by site from red, brown, clear and green. Tracks observed most often included birds, raccoon, deer, and livestock. Observed trash was predominantly plastics and aluminum cans, and was most common at bridge crossings. There was evidence of illegal dumping from the bridge at BF003 off the Coleman Park Road. Trash on private lands was rare and appeared to have washed in during high flow periods.

Table 3.5 Stream Channel and corridor characteristics for each site along Buffalo Creek (0214B).

Site Number	Stream Channel Appearance	Dominant Substrate	Corridor Appearance	Riparian Size	Park	Landscape Surroundings
BF001	Natural	Mud/Clay/Gravel	Forest	Large	No	Native
BF002	Natural	Mud/Clay/Riprap/Concrete	Shrubs	Large	No	Native
BF003	Natural	Mud/Clay	Forest	Large	No	Native
BF004	Natural	Mud/Clay	Forest	Large	No	Native
BF005	Natural	Mud/Clay/Gravel	Shrubs	Large	No	Improved Pasture
BF006	Natural	Mud/Clay	Shrubs with Trees	Large	No	Native
BF007	Natural	Mud/Clay	Shrubs	Large	No	Native pastureland
BF008	Natural	Mud/Clay	Pasture	Large	No	Native pastureland
BF009	Natural	Mud/Clay	Shrubs	Large	No	Native
BF010	Natural	Mud/Clay	Shrubs	Large	No	Native pastureland
BF011	Natural	Mud/Clay	Shrubs	Large	No	Native

Table 3.6 Thalweg depth, stream flow type, and site accessibility during the two surveys of Buffalo Creek (0214B).

Stream flow type represents TCEQ descriptions (TCEQ, 2013). Under general access, * indicates that the site was publically accessible at a road crossing but that further access was limited by fencing of private property. For bank access, E = Easy, ME = Moderately Easy, MD = Moderately Difficult, and D = Difficult.

Site	Transect length (m)	# of Transects	# of Recreational Areas at Site	Avg. Site Thalweg Depth (m) for Trip 1	Avg. Site Thalweg Depth (m) for Trip 2	Stream Flow Type	General Access	Bank Access
BF001	300	11	0	0.29	0.34	Intermittent with pools	Public*	MD
BF002	300	11	0	0.11	0.16	Intermittent with pools	Public*	MD
BF003	300	11	0	0.13	0.10	Intermittent with pools	Public*	MD
BF004	300	11	0	0.21	0.13	Intermittent with pools	Private	ME
BF005	300	11	0	0.25	0.05	Intermittent with pools	Public*	MD
BF006	300	11	0	0.13	0.13	Intermittent with pools	Private	MD
BF007	300	11	0	0.17	0.14	Intermittent with pools	Private	MD
BF008	300	11	0	0.32	0.02	Intermittent with pools	Public*	ME
BF009	300	11	0	0.16	0.04	Intermittent with pools	Private	D
BF010	300	11	0	0.27	0.0	Intermittent with pools	Private	D
BF011	300	11	0	0.13	0.0	Intermittent with pools	Public*	ME

Table 3.7 Description of surveyed stream sites along Buffalo Creek during first survey performed in June 2013.

Site Number	Maximum Width (m)	Minimum Width (m)	Typical Average Width (m)	Observed Flow
BF001	5.2	1.2	3.2	Low
BF002	4.2	1.8	3.0	Normal
BF003	3.1	0.0	2.2	Normal
BF004	4.6	0.3	2.5	Low
BF005	10	1.6	3.5	No Flow
BF006	2.8	0.0	2.4	No Flow
BF007	3.4	0.66	2.8	Low
BF008	3.0	1.1	2.0	Low
BF009	2.5	1.4	2.0	Low
BF010	1.6	1.0	1.2	Low
BF011	2.0	0.6	0.7	Low

Table 3.8 Description of surveyed stream sites along Buffalo Creek during second survey performed in July 2013.

Site Number	Maximum Width (m)	Minimum Width (m)	Typical Average Width (m)	Observed Flow
BF001	5.4	1.9	3.0	Low
BF002	5.3	1.0	2.5	Normal
BF003	4.9	0.0	1.0	Low
BF004	4.5	0.0	2.2	No Flow
BF005	5.0	0.0	0.0	No Flow
BF006	2.9	0.0	0.0	No Flow
BF007	2.7	0.0	2.0	No Flow
BF008	2.4	0.0	0.0	No Flow
BF009	1.8	0.0	0.0	No Flow
BF010	0.0	0.0	0.0	Dry
BF011	0.0	0.0	0.0	Dry

Table 3.9 Stream aesthetics along Buffalo Creek during first survey performed in June 2013.

A = absent, R = rare, C = common, Ab = abundant, N = none, NW = no water, SP = slight presence, MP = moderate presence, LP = large presence from Field Data Sheet – Sect. F.

Site	Aquatic Vegetation	Algae Cover	Odor	Color	Bottom Deposit	Water Surface	Reptiles	Water Dependent Birds	Mammals	Evidence of Wildlife	Large Garbage in Channel	Small Garbage in Channel	Bank Garbage
BF001	R	R	R	Red	Fine Sediment	Clear	N	N	SP	Tracks/Fecal/Nests	N	R	R
BF002	C	R	R	Brown	Fine Sediment/Sludge	Clear	MP	N	SP	Tracks/Fecal	C	C	C
BF003	R	C	C	Brown	Fine Sediment	Scum	N	N	N	Tracks/Fecal	Ab	Ab	C
BF004	R	A	N	Red	Fine Sediment	Clear	N	N	SP	Tracks/Fecal/Nests	N	R	N
BF005	A	A	R	Brown	Fine Sediment	Clear	N	N	N	Tracks/Fecal	N	R	R
BF006	A	A	N	Clear	Fine Sediment	Clear	N	N	SP	Tracks/Fecal	N	R	N
BF007	C	R	N	Red	Fine Sediment	Clear	N	N	SP	Tracks/Fecal	N	N	N
BF008	A	R	N	Clear	Fine Sediment	Clear	N	N	N	Tracks/Fecal	N	R	N
BF009	A	R	N	Green	Fine Sediment	Clear	MP	SP	SP	Tracks/Fecal/Nests	N	R	R
BF010	A	R	N	Green	Fine Sediment	Clear	N	N	SP	Tracks/Fecal	N	N	N
BF011	A	A	R	Green	Fine Sediment	Clear	N	N	N	Tracks/Fecal	N	R	N

Table 3.10 Stream aesthetics and wildlife observations along Buffalo Creek during the second survey performed in July 2013.

A = absent, R = rare, C = common, Ab = abundant, N = none, NW = no water, SP = slight presence, MP = moderate presence, LP = large presence from Field Data Sheet – Sect. F.

Site	Aquatic Vegetation	Algae Cover	Odor	Color	Bottom Deposit	Water Surface	Reptiles	Water Dependent Birds	Mammals	Evidence of wildlife	Large garbage in Channel	Small garbage in Channel	Bank garbage
BF001	C	A	R	Brown	Fine Sediment	Clear	N	N	SP	Tracks/Fecal	R	R	N
BF002	C	A	C	Brown	Fine Sediment/Sludge	Clear	N	N	SP	Tracks/Fecal/Nests	C	C	C
BF003	R	R	R	Clear	Sludge	Clear	SP	SP	SP	Tracks/Fecal	R	C	R
BF004	A	A	N	Brown	Fine Sediment	Clear	N	N	N	Tracks/Fecal	R	R	N
BF005	A	A	N	Brown	Fine Sediment	Clear	N	N	MP	Tracks/Fecal	R	C	R
BF006	A	A	N	Brown	Fine Sediment	Clear	N	N	N	Tracks/Fecal	R	R	N
BF007	C	A	R	Brown	Fine Sediment	Clear/Scum	N	N	SP	Tracks/Fecal	N	R	N
BF008	A	A	N	NW	Sludge	NW	SP	N	SP	Tracks/Fecal/Nests	N	R	R
BF009	A	A	R	Brown	Fine Sediment	Scum	N	N	N	Tracks/Fecal/Nests	N	R	N
BF010	A	A	N	NW	Fine Sediment	NW	N	N	N	Tracks/Fecal	R	R	N
BF011	A	A	N	NW	Fine Sediment	NW	N	N	N	Tracks/Fecal	N	R	N

Physical Description of BF001

Buffalo Creek at site BF001 was surveyed on June 8 and July 20, 2013. Access to this site was easy because it occurred at a road crossing. However, access into the stream was moderately difficult because it required landowner permission to cross a fence that bisected the creek. Deep clay mud in the creek bottom caused considerable sinking when walking the creek (Tables 3.5 and 3.6). In addition, this site had dense vegetation and steep banks. Forested banks were characterized by dense growth of salt cedar and mesquite making access to the 300 m stretch difficult. Fallen tree limbs were obstacles to be avoided when walking this stretch of the stream.

The stream was wadeable with water levels averaging 0.32 m for the two surveys (Table 3.6). One substantial pool was encountered during the first survey that measured 13 m long, 4.0 m wide and 0.72 m deep. The stream had an average width of about 3 m during both surveys and low flow (Tables 3.7 and 3.8).

The stream channel was naturally vegetated, primarily with salt cedars (*Tamarix* sp.), mesquite and Bermuda grass. Banks were steep and sloughing in some places making travel up the banks difficult to impossible. There was some algae cover on the water during the first survey but was more abundant during the second survey. The color of the water body was brown throughout. Raccoon tracks and gnaw marks on trees from beavers were observed as well as bird nests under the bridge, rabbits, and clams. Various types of feces were observed as well. Garbage such as, metal pipe, tires, metal barrels, polystyrene, glass bottles, and general plastics in the stream were present but rare (Table 3.9 and 3.10). No evidence of human recreation was observed.



Figure 3.3 Photograph of Buffalo Creek at Site BF001. Downstream view of the 150-m transect on July 7, 2013.



Figure 3.4 Photograph of Buffalo Creek at Site BF001 taken June 8, 2013, downstream view at 40-m. Note log obstruction, dense vegetation and steep banks. TIAER personnel in photograph.

Physical Description of BF002

Buffalo Creek at site BF002 was surveyed on June 8 and July 20, 2013. Access to this site was similar to BF001, because it too occurred at a road crossing. However, access into the stream was moderately difficult because it required landowner permission to cross a fence that bisected the creek, in addition to dense vegetation and steep banks (Tables 3.5 and 3.6). Forested banks were characterized by dense growth of salt cedar and mesquite making access to the 300m stretch difficult. Travel through the stream corridor was difficult due to the deep clay bottom, underlying sharp metal garbage and large obstacles of downed trees and concrete.

The stream was wadeable with average width of 2.8 m (Tables 3.7 and 3.8) and average thalweg depth of 0.14 m for the two surveys (Table 3.6). Stream flow appeared normal during both surveys (Tables 3.7 and 3.8).

The stream channel was naturally vegetated with a variety of shrubs at the banks, clearing out to pasture beyond the banks (Table 3.5). The water surface was clear with a brown coloration and a foul odor when the underlying sediment was disturbed (Table 3.9 and 3.10). Wildlife observed included numerous snakes, a snapping turtle, rabbit, and birds. The tracks of raccoon, deer, turtle, cattle, dog and snakes were also seen. Numerous types of garbage were commonly observed such as tires, bottles, cans, feed sack, plastic bag, polystyrene products, and polyethylene pipe (Tables 3.9 and 3.10). During the first survey, a canoe and what appeared to be a bag of supplies was observed on the left bank (Figure 3.7). No other signs of human recreation were observed.



Figure 3.5 Photograph of Site BF002 taken on June 8, 2013, upstream view at 30-m transect.



Figure 3.6 Photograph of site BF002 taken July 20, 2013. Downstream view at 30-m transect. Note log and large garbage obstructions.



Figure 3.7 Photograph of Site BF002 taken June 8, 2013 of canoe on left bank approximately 150-m from bridge.

Physical Description of BF003

Buffalo Creek at site BF003 was surveyed on June 14, and July 20, 2013. Access to this site was similar to BF002 and easy, because it occurred at a road crossing. However, access into the stream was moderately difficult because it required landowner permission to cross a fence that bisected the creek, in addition to dense vegetation and steep banks (Table 3.5 and Figure 3.8). Travel down the stream was difficult because of large accumulations of debris composed of logs, limbs and garbage (Figure 3.9). Dense vegetation in the stream also made negotiating the creek difficult.

The stream was wadeable with average width of 2.2 m during the first survey, 1m during the second survey and an average thalweg depth 0.07 m. The stream appeared to have normal flow during the first survey but low during the second (Tables 3.6, 3.7 and 3.8).



Figure 3.8 Photograph of Site BF003, taken on June 14, 2013, upstream view at 300-m transect under the bridge.



Figure 3.9 Photograph of BF003 taken on July 20, 2013, downstream view at 30-m transect. Note significant debris accumulation.

The stream channel was naturally vegetated with a variety of shrubs at the banks, clearing out to pasture beyond the banks (Table 3.5). Some aquatic vegetation including cattails were present but rare. The water surface was predominantly clear with a brown coloration and an occasional foul odor (Tables 3.9 and 3.10). Neither wildlife nor livestock were observed during the first survey but during the second survey snakes, crayfish, tadpoles, and horses were seen in the creek. Tracks of cattle, raccoon, skunk, small mammals, and dove were observed in addition to a cow carcass and some dead crayfish. Feces of birds, horses and cows were seen as well. Large garbage was observed at the bridge where it appears to have been discarded along with carcasses of various other animals including deer (Figure 3.10). Garbage ranged from a television and feed sacks to a vacuum cleaner, tires, and various glass bottles. Cardboard from fireworks that had been set off in the creek bed beside the water were documented; the only evidence of recreation observed. No other signs of human recreation were observed.



Figure 3.10 Photograph of Site BF003, downstream view at 30-m transect. Note animal carcass and television. TIAER personnel in photograph.

Physical Description of BF004

BF004 was surveyed on June 8, and July 20, 2013. No public access to this site was available and only possible with landowner permission and escort to the site which was approximately 1 mile from a public road, down a private dirt road. Once at the site, access into and through the stream was moderately easy except for some steep banks in some places (Table 3.5 and Figure 3.11).



Figure 3.11 Photograph of Site BF004, downstream view at 30-m transect. Note steep banks on right side and more gradual bank on left.

This stream was wadeable, although a small logjam obstruction was encountered (Figure 3.12). Average thalweg depth for the first survey was 0.21 m and 0.13 m during the second survey (Table 3.6). During the first survey, the creek was exhibiting low flow and categorized as no flow during the second survey. Average widths on the first survey were 2.5 m and 2.2 m during the second (Tables 3.7 and 3.8).

Most of this stream was shaded by native forest and shrubland vegetation on both sides of the corridor (Table 3.5 and Figure 3.12). Banks were steep in places but broken down in others where livestock entered the creek. The creek bottom was primarily a fine sediment mud. The water surface was clear and the color of the water was a reddish brown. Wildlife evidence included tracks of hog and deer, feces of bird and cow, gnaw marks of a beaver, and a half of a clam shell observed in the stream channel. Minimal garbage was seen including a plastic jug and a glass bottle (Tables 3.9 and 3.10). No evidence of human recreation was observed.



Figure 3.12 Photograph of BF004 taken on June 8, 2013 of log obstruction near the 30-m transect. TIAER personnel in photograph.

Physical Description of BF005

BF005 was surveyed on June 8, and July 20, 2013. Access to this site was easy because it occurred at a road crossing. However, access into the stream was moderately difficult because it required landowner permission to cross a fence that bisected the creek, in addition to dense vegetation and steep banks (Figure 3.13). Additionally access is discouraged by the landowner, evidenced by multiple “no trespassing” signs. Once in the creek, travel through the corridor was moderately difficult. The riparian area of the creek was comprised of natural shrubland, opening up to improved pasture beyond the immediate vicinity of the creek (Table 3.5). There was a large culvert a few meters from the bridge, where a right-of-way passed over the creek that had a large accumulation of logs and a discarded mattress, which greatly impeded travel through the corridor (Figure 3.14). Multiple log jams obstructed travel throughout the 300-m reach and steep banks were often encountered.

During both trips this reach of the creek was not flowing and only held standing water. During the first survey, there was one measureable pool that was 17 m long, 10 m wide, and 0.6 m deep (Tables 3.7 and 3.8). Average thalweg depths for this site were 0.24 m during the first survey and 0.05m for the second (Table 3.6).



Figure 3.13 Photograph of BF005 taken on July 20, 2013, downstream view at 30-m transect. TIAER personnel in photograph.



Figure 3.14 Photograph of BF005 taken on June 8, 2013 of mattress and logs jamming the culvert. TIAER personnel in photograph.

The water surface was clear and the color was brown (Figure 3.15). The creek bottom was a fine sediment mud, which contributed to some of the difficulty in walking. Hazardous vegetation including poison ivy (*Toxicodendron* sp.) was prolific.



Figure 3.15 Photograph of Site BF005, upstream view at 150-m transect. Note tire and log jam.

Wildlife evidence included observation of a snapping turtle and tracks of hog, raccoon, cat, deer and snake. Garbage was rare for the majority of this site but was common at the bridge including a plastic bag, tire, computer parts, bottles, cans, mattress, large metal scraps, generator, and a television (Tables 3.9 and 3.10). A hunting blind and feeder were observed and documented on the banks of the creek (Figures 3.16 and 3.17). No other indicators of human recreation were observed.



Figure 3.16 Photograph of BF005, taken on June 8, 2013, deer feeder at 210-m.



Figure 3.17 Photograph of BF005, taken on June 8, 2013, hunting blind at 210 m. TIAER personnel in photograph.

Physical Description of BF006

Site BF006 was surveyed on June 8 and July 20, 2013. No public access to this site was available. Access was only possible with landowner permission and escort to the site, which was approximately a half mile from a public road, down a private dirt road. Travel down into the stream was moderately difficult due to thick vegetation, steep slopes, and sticky mud (Table 3.6). Multiple obstructions and a cross fence also impeded travel through the streambed (Figure 3.18).



Figure 3.18 Photograph of Site BF006 taken June 8, 2013, upstream view at 300-m transect with a fence intersecting the stream.

This stretch of the creek was not flowing during either of the two surveys. Average thalweg depths were 0.13 m for both site surveys (Table 3.6), and stream widths were never greater than 2.9 m (Tables 3.7 and 3.8).

The riparian corridor at this site was primarily native shrub community with interspersed trees (Table 3.5). The creek bottom was a fine sediment mud. The water surface was clear and the color was clear during the first survey, but during the second survey, however, there was considerably less water and it had a brown coloration (Tables 3.9 and 3.10). Wildlife evidence observed included tracks of canine, large cat, raccoon, and deer. Cattle tracks were also seen. Garbage was rarely encountered, but included a discarded office chair and a glass insulator (Figure 3.19). No evidence of human recreation was observed.



Figure 3.19 Photograph of Site BF006 taken July 20, 2013, broken office chair in stream.

Physical Description of BF007

BF007 was surveyed on June 8 and July 20, 2013. No public access to this site was available and was only possible with landowner permission and escort to the site, through a locked gate and down a private dirt road approximately a quarter-mile. Once at the site, entering the stream was moderately difficult due to dense vegetation and steep slopes with slick, muddy sides (Table 3.5). Multiple log jam obstructions (Figure 3.20) and a cross fence with welded wire water gap also impeded travel through the stream bed (Figure 3.21).

This portion of Buffalo Creek was wadeable and water existed throughout the 300-m stretch during the first survey. However, it was not flowing during the second survey, as represented by the absence of water at the 90-m transect. Average thalweg depths for the first and second surveys were 0.17 m and 0.14 m respectively (Table 3.6). The typical stream width during the first survey was approximately 2.8 m and 2.0 m during the second survey (Tables 3.7 and 3.8).

The creek bottom was characterized by a fine sediment mud, which caused some sinking when wading through it (Table 3.5). The water surface during the first survey was clear and was red in color (Table 3.9). During the second survey, with lower water levels, the water surface was clear with scum in some places and the color of the water was brown (Table 3.10).



Figure 3.20 Photograph of Site BF007 taken on June 8, 2013, downstream view at a large debris accumulation in the stream at the 150-m transect.



Figure 3.21 Photograph of BF007 taken on June 8, 2013, upstream view at 300-m transect. Note steep vegetated banks and cross fence with welded wire water gap.

The banks at this site were dominated by shrubs with interspersed trees on both sides opening up to native pasture beyond (Table 3.5). Large aquatic vegetation was present in the water during the first survey, but less abundant during the second. Various animal tracks were observed including cat, beaver, and hog. Other evidence of beaver activity included gnaw marks on a tree. A squirrel was observed as was a bird nest and crayfish burrows. The channel at this site was almost completely free of garbage, although one aluminum can was seen (Tables 3.9 and 3.10). A PVC gravity corn feeder was observed on the banks wired to a tree (Figure 3.22). No other evidence of human recreation was observed.



Figure 3.22 Photograph of BF007 taken on July 20, 2013, PVC gravity corn feeder wired to a tree.

Physical Description of BF008

BF008 was surveyed on June 8 and July 20, 2013. Access to this site was easy because it occurred at a road crossing. However, access into the stream was moderately difficult because it required landowner permission to cross a barbed wire fence that bisected the creek (Figure 3.23). Once in the channel travel through the corridor was moderately easy. At specific locations movement became more difficult, for instance, a stretch where deep mud made wading challenging and others where large log obstructions required climbing out of the channel and circumnavigating the obstruction before proceeding with the survey (Figure 3.24).



Figure 3.23 Photograph of BF008 taken on July 20, 2013 downstream view at 30-m transect. Note private barbed wire fence line and log jam.

The stream at this site was wadeable. Flow during the first survey was considered low but had reduced to no flow by the second survey. Average thalweg depths for the first and second surveys were 0.32 m and 0.02 m respectively (Table 3.6). Typical widths of the stream during the first survey were approximately 2.0 m, however during the second survey water levels were significantly lower and typically 0.0 m (Tables 3.7 and 3.8).

The creek bottom was primarily fine sediment mud/clay mix that, during the second survey, had more of a consistency of sludge since there was less water (Table 3.5). The water surface during the first survey was clear and water was mostly absent during the second survey (Tables 3.9 and 3.10). The banks at this site were characterized by shrubs and small trees in the immediate vicinity of the creek, opening up into native pasture beyond. Evidence of a wildfire or prescribed burn was observed in the vegetation on the right bank beyond the shrubs and small trees. Presence of garbage was rare in the form of a shingle, 5-gallon bucket and some aluminum cans. A metal pipe was also observed hanging off the bank out in to the stream channel. Evidence of livestock in the form of cattle tracks and feces was observed in addition to travel corridors leading down the banks and across the creek (Figure 3.25). Wildlife observed included green tree snake, lizard and leeches. Tracks of various animals were seen including deer, hog, rabbit, raccoon, cat, small rodents, turkey and armadillo. Also observed were a bird nest and bird droppings. No evidence of human recreation was observed.



Figure 3.24 Photograph of Site BF008, taken on June 8, 2013 of a large log jam at 210-m. Note the steep bank beyond the jam.



Figure 3.25 Photograph of BF008 taken on June 8, 2013 of wildlife and livestock travel corridor leading into creek.

Physical Description of BF009

BF009 was surveyed on June 8 and July 20, 2013. No public access to this site was available and required permission from the landowner to enter the property through a gate and cattle guard then travel approximately a mile down a dirt road. Once at the site, entering the stream was difficult due to dense vegetation and steep banks (Table 3.6 and Figure 3.26). The muddy/clay bottom of the stream also made wading through the channel physically demanding. The channel was narrow, densely vegetated and travel was impeded by log jams (Table 3.5).



Figure 3.26 Photograph of site BF009 taken on June 8, 2013, upstream view at 30-m transect. Note the steep banks, water levels and debris.

This stretch of the creek was wadeable throughout the 300-m reach that was surveyed. During the first survey, the flow rate was low and dropped to a no flow designation during the second survey. The water surface appeared clear of surface algae and green in color during the first survey (Figure 3.26). During the second survey very little water was encountered, and the water that was observed took on a surface scum and appeared brown in color (Figure 3.27). The widths observed during the first survey averaged 2.0 m (Table 3.7). During the second survey the majority of the 300-m stretch had no measureable water (Figure 3.28), and the widest transect point measured was 1.8 m (Table 3.8). Thalweg depths were shallow measuring 0.15 m during the first survey and 0.04 m during the second survey (Table 3.6)



Figure 3.27 Photograph of site BF009 taken on July 20, 2013, downstream view at 150-m transect. Note narrow channel, steep banks and dense vegetation on the left.



Figure 3.28 Photograph of site BF009 taken on July 20, 2013, upstream view at 30-m transect. Note absence of water and debris. TIAER personnel in photograph.

Again, the bottom was a fine sediment mud making wading though it moderately challenging. Log jams were observed at the 15-m, 20-m and 65-m transects. The banks were dominated by shrubs immediately at the edge but opening up to pasture a short distance from the banks (Table 3.5). Observed evidence of wildlife included raccoon and canine tracks, a hog skull, bird nest and an agitated rattlesnake at the 210-m transect that, without prior notice, struck at one of the field crew. Cattle tracks were also observed in the creek. Garbage was minimal. A metal pipe stuck down into the creek and running up the bank and another running transverse across the channel, a few bottles and a discarded flip-flop were noted (Tables 3.9 and 3.10). No evidence of human recreation was observed.

Physical Description of BF010

BF010 was surveyed on June 8 and July 20, 2013. No public access to this site was available and required landowner permission to pass through a gate with a cattleguard, onto fenced private property and approximately a half-mile down a dirt road to the creek. Once at the site, entering the stream was difficult due to excessively dense vegetation and steep banks (Figure 3.29). The muddy/clay bottom of the stream also made wading through the channel physically demanding even when water was very limited (Table 3.5 and Figure 3.30). Travel was impeded by dense vegetation, narrow channel, and a log jam at the 290-m transect.

This site was wadeable throughout the 300-m stretch. Flow was low during the first survey with a typical average stream width of 1.2 m and average thalweg depth of 0.27 m (Tables 3.6 and 3.7). The water surface was clear of any residue or plant matter and was green in color (Table 3.9). However, the creek was dry at the time of the second survey (Table 3.8).

Again, the bottom of the creek was a fine sediment mud which did make wading and traversing up the banks a struggle. The corridor was densely vegetated with grasses and weeds but dominated by shrubs and small trees. Pastureland characterized the landscape once out of the immediate vicinity of the creek (Table 3.5). Indications of wildlife presence included tracks of hog, bird, canine, rabbit, raccoon, and deer. Other signs included crayfish burrows, cat scat, bird nest and a turtle shell. Garbage in the stream was not observed during the first survey, however some was detected during the second survey. A large segment of iron pipe was seen on the banks and various other smaller metal and polyethylene pipe were seen in the creek. Other notable garbage was a snuff can, tire and a flip-flop (Figures 3.9 and 3.10). No evidence of human recreation was observed at this site.



Figure 3.29 Photograph of BF010 taken on June 8, 2013, at 190-m transect. Note narrow channel, dense vegetation and pipe in stream.



Figure 3.30 Photograph of BF010 taken on July 20, 2013, upstream view at 30-m transect. Note lack of water, muddy substrate, dense vegetation and steep banks.

Physical Description of BF0011

BF011 was surveyed on June 8 and July 21, 2013. Access to this site was easy because it occurred at a road crossing. However, access into the stream was moderately easy after acquiring landowner permission to cross a fence that bisected the creek. The creek at this site cut a narrow channel with dense bunchgrass vegetation on the banks but did not significantly impede travel through the corridor (Figure 3.31).



Figure 3.31 Photograph of site BF011, upstream view at 150-m transect. Note narrow channel and thick vegetation.

This site was wadeable throughout the 300-m stretch. Flow was low during the first survey with a typical average width of 0.7m and an average thalweg depth of 0.27 m (Table 3.6 and 3.7). This site was dry at the time of the second survey (Table 3.8).

During the first survey, when water was present, the surface conditions were clear with a green coloration. The dominate substrate of the creek bottom was a fine sediment mud but did not significantly cause difficulty when wading through. The landscape surrounding this site was predominately pasture with scattered small shrubs of buttonbush (*Cephalanthus* sp.), mesquite and salt cedar (Table 3.5).

Indications of wildlife presence included tracks of raccoon, canine, bird, deer and turtle. Fecal material of bird, cattle, and some of unknown origin was documented. Bones of a deceased cow were seen and the call of a bobwhite quail was heard. At the 110-m transect a livestock trail was observed crossing through the creek (Figure 3.32) and evidence of a depredated turtle nest was observed. Although garbage was rarely seen at this site, a plastic oil can and styrofoam were

observed in addition to black polyethylene pipe traversing the creek channel (Tables 3.9 and 3.10). No indications of human recreation were observed.



Figure 3.32 Photograph of BF011 taken on June 8, 2013, of a livestock crossing at 110-m transect.

Observation and Interviews

Activities Observed for Buffalo Creek (0214B)

During each RUAA survey, field personnel visited the sites during times of days and on days when recreational activities were apt to be observed. Six of the eleven selected sites were at road crossings that provided public access, although only at the bridge that crosses the stream. The remaining five sites were located on private property and TIAER personnel were granted permission from the landowners to conduct the RUAA at these locations.

No contact (primary or secondary) or noncontact recreational activities were observed by TIAER employees at any of the sites during the field surveys. The only evidence field personnel found of any possible recreation occurring was at Site BF002. A canoe and a pack with unknown contents were found on the bank of the stream (Figure 3.7). No evidence of recreation was found at any of the other sites.

Activities Interviewed for Buffalo Creek (0214B)

Interviews were conducted with landowners along Buffalo Creek as well as other persons of interest. A total of twenty-five were collected. No primary contact recreational activities were

identified from these interviews (Table 3.11). However, at sites BF002, BF003, BF007, BF009, BF010, and BF011, interviewees indicated that he/she had hunted, observed hunting, and had heard of hunting taking place at these sites. Fishing was reported to have taken place at sites BF001 and BF002. Seven interviews were conducted that were not associated with any specific site and are categorized as general. Hunting and fishing were the only recreational activities indicated by these general interviews.

Table 3.11 and Figure 3.22 summarize the types of recreation indicated from interviews.

Table 3.11 Summary of interviews from Buffalo Creek.

Activities are listed as the number of times personal use, observed use, or heard of use was documented from interviews for a given location or general to the assessment unit. Blank cells indicate no interviewed feedback for that location. An * indicates recreation at multiple sites from one interview forms.

Site Name	Swimming	Adult Wading	Children Wading	Hunting	Fishing	Boating/Canoeing
BF001	0,0,0	0,0,0	0,0,0	0,0,0	1,0,0	0,0,0
BF002	0,0,0	0,0,0	0,0,0	1,1,2	1,1,2	0,0,0
BF003	0,0,0	0,0,0	0,0,0	0,0,1	0,0,0	0,0,0
BF004						
BF005						
BF006						
BF007	0,0,0	0,0,0	0,0,0	1,0,0	0,0,0	0,0,0
BF008						
BF009	0,0,0	0,0,0	0,0,0	1,1,1	0,0,0	0,0,0
BF010	0,0,0	0,0,0	0,0,0	*	0,0,0	0,0,0
BF011	0,0,0	0,0,0	0,0,0	*	0,0,0	0,0,0
General	0,0,0	0,0,0	0,0,0	1,0,0	1,0,1	0,0,0
Totals	0,0,0	0,0,0	0,0,0	4,2,4	3,1,2	0,0,0

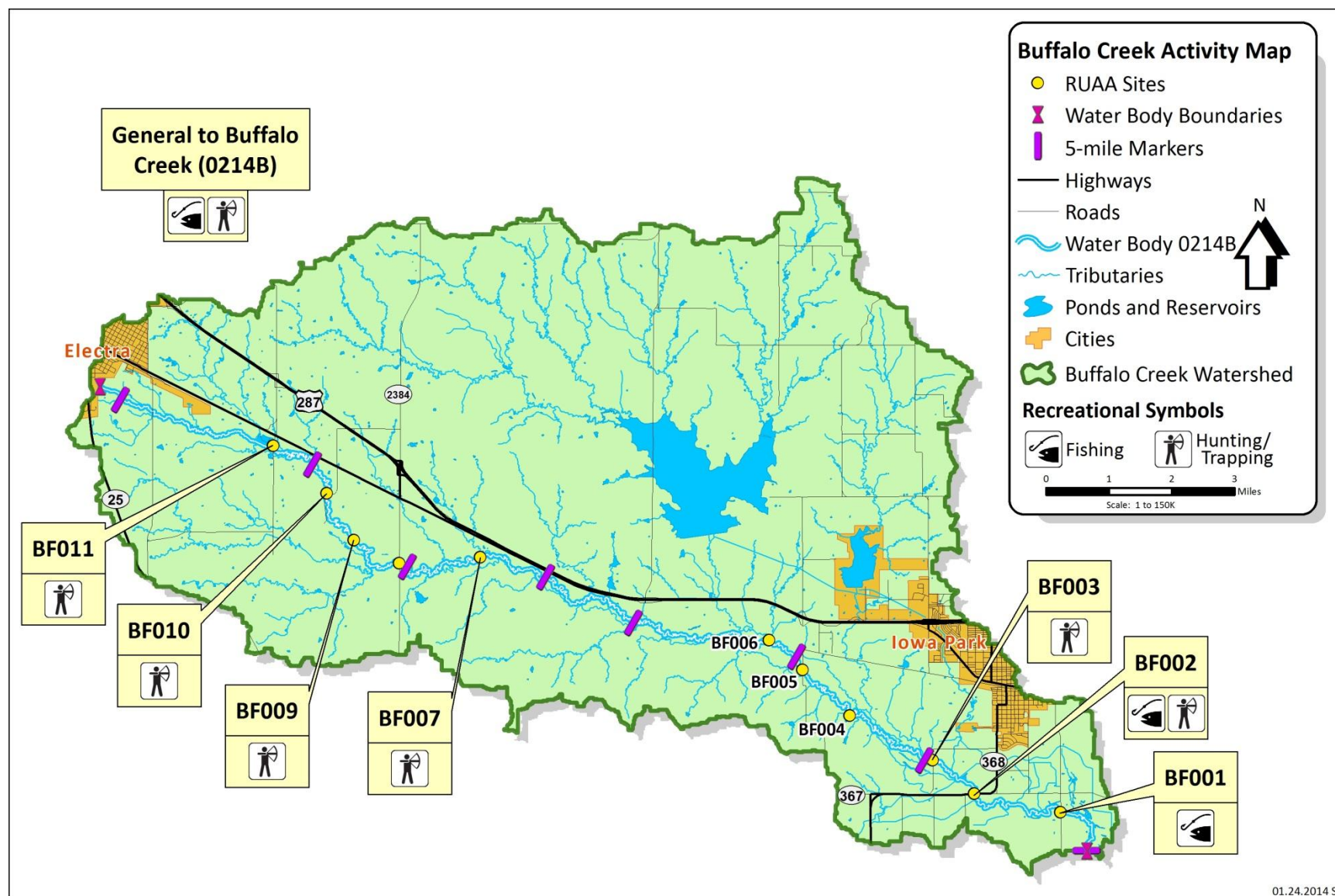


Figure 3.33 Summary of observed and interviewed human activities on Buffalo Creek

Summary

RUAA surveys were conducted at eight sites along Buffalo Creek (0214B) on June 8 and 14, 2013 and July 20, 2013. During the two surveys, there were no recreational activities observed by TIAER field staff. Additionally, there were no non-contact recreational activities observed during either survey. Recreational activities reported by interviewees are summarized in Figure 3.33 and the overall RUAA findings are summarized in the form below.

The Palmer Drought Severity Index (PDSI) represented extreme drought conditions during the first survey in May 2013 and moderate drought conditions during the second survey in July 2013 (TWDB, 2013).

While conducting the stream surveys, no characteristics, such as boat docks, parks, playgrounds, biking trails, campgrounds, or sports fields, were encountered that would promote recreation.

The rural nature of the area surrounding Buffalo Creek is an impediment to recreation. Except for sites BF001, BF002, BF003, BF005, BF008 and BF011, which are located at road crossings, all other access to Buffalo Creek is through private property that are fenced, gated, and locked. Access to most of the stream can only be gained through these properties by permission of the landowner. Additionally, dense aquatic vegetation and the sludge-like bottom of the stream where water was present would make any form of recreation difficult. According to the interviewees, there is typically insufficient water to afford primary contact recreation. In most of the reach, there was limited water to allow any form of water recreation.

RUAA Summary

Name of water body: Paradise Creek
Segment No. of Nearest Downstream Segment No.:0230A
Classified?:No
County: Wilbarger & Foard

1. Observations on Use

- a. Do primary contact recreation activities occur on the water body?
☐ frequently ☐ seldom ☒ not observed or reported ☐ unknown
- b. Do secondary contact recreation 1 activities occur on the water body?
☐ frequently ☒ seldom ☐ not observed or reported ☐ unknown
- c. Do secondary contact recreation 2 activities occur on the water body?
☐ frequently ☒ seldom ☐ not observed or reported ☐ unknown
- d. Do noncontact recreation activities occur on the water body?
☐ frequently ☐ seldom ☒ not observed or reported ☐ unknown

2. Physical Characteristics of Water Body

- a. What is the average thalweg depth? 0.149 meters
- b. Are there substantial pools deeper than 1 meter? ☐ Yes ☒ No
- c. What is the general level of public access?
☐ easy ☐ moderate ☒ very limited

3. Hydrological Conditions of site visits (Based on Palmer Drought Severity Index)

- ☒ Mild-Extreme Drought
- ☐ Incipient dry spell
- ☐ Near Normal
- ☐ Incipient wet spell
- ☐ Mild-Extreme Wet

Chapter 4

Paradise Creek

(0230A)

Watershed Characteristics

The Paradise Creek watershed covers 72,190 acres and encompasses the community of Thalia (estimated population 104) and small portions of the City of Vernon (estimated population 11,686) (Figure 4.1). The watershed overlays a portion of the Seymour Aquifer which consists of alluvial sediments (George, et al., 2011). The terrain varies from flat to rolling hills with fine, sandy loam soils (TSHA, 2013b).

Paradise Creek watershed lies within the Red Prairie ecoregion (27h) (Griffith, et al., 2007). Much of the Red Prairie ecoregion is used for crop cultivation, and within the Paradise Creek watershed nearly 60 percent is classified as cultivated cropland (Figure 4.2). Average rainfall for the ecoregion ranges from 20 to 28 inches annually. Mean minimum and maximum temperatures for the region range from 31 to 55°F in January and 71 to 95°F for July. Paradise Creek is classified as an intermittent stream with pools (TCEQ, 2013), although recent periods of extended drought have left the creek dry for long periods throughout the year. Along the stream riparian area shrub/scrub is predominant, although some forest occurs (Figure 4.2). Woody vegetation in the Red Prairie ecoregion consists heavily of mesquite (*Prosopis glandulosa*) and salt cedar (*Tamarix* spp.) along with other trees, such as pecan (*Carya illinoensis*), American elm (*Ulmus americana*), black willow (*Salix nigra*), little walnut (*Juglans microcarpa*), netleaf hackberry (*Celtis reticulata*), bumelia (*Bumelia lanuginosa*), and western soapberry (*Sapindus saponaria*) (Griffith, 2007).

Designated Uses, Impairments, and Concerns

Paradise Creek has designated uses of primary contact recreation, general use, and fish consumption with limited aquatic life use (TCEQ, 2013). Paradise Creek was first listed as impaired for bacteria on the 2006 Texas 303(d) list. Chlorophyll-a and nitrate are listed as parameters of concern.

Permitted Discharges

The North Texas State Hospital Vernon Campus South WWTF (TX0030732) is located within the Paradise Creek watershed on the south side of FM 433 approximately 2.3 mi east of FM 2074. The WWTF is permitted to discharge a maximum daily average of 0.024 MGD (Macias, 2013). The facility has been unoccupied since 2009, and is maintained by the North Texas State Hospital (Hoban, 2013). There was no effluent *E. coli* concentration data available online for this facility (EPA, 2013).

There are currently no permitted concentrated animal feeding operations within the Paradise Creek watershed.

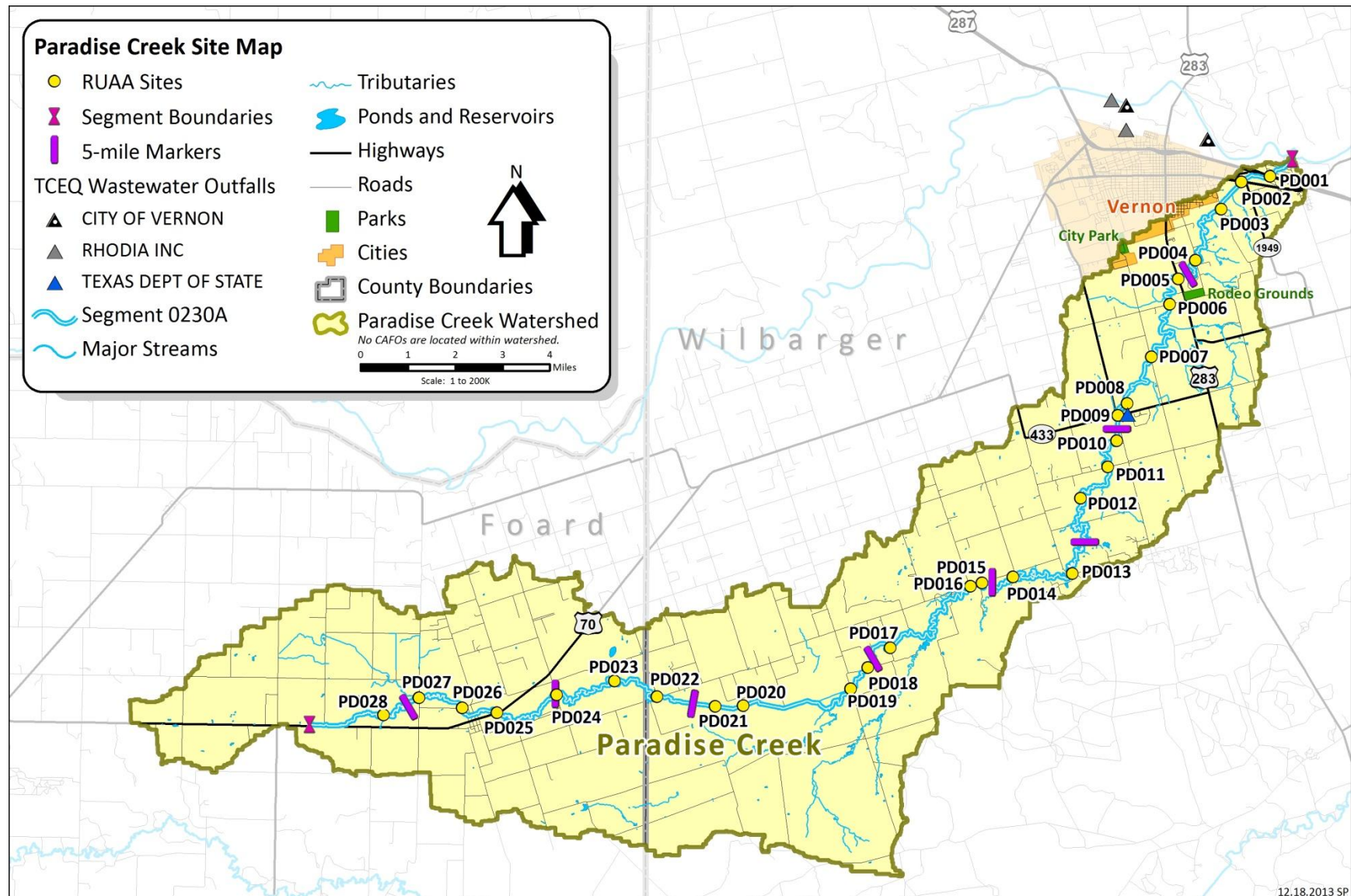


Figure 4.1 Overview of Paradise Creek watershed and RUAA sites.

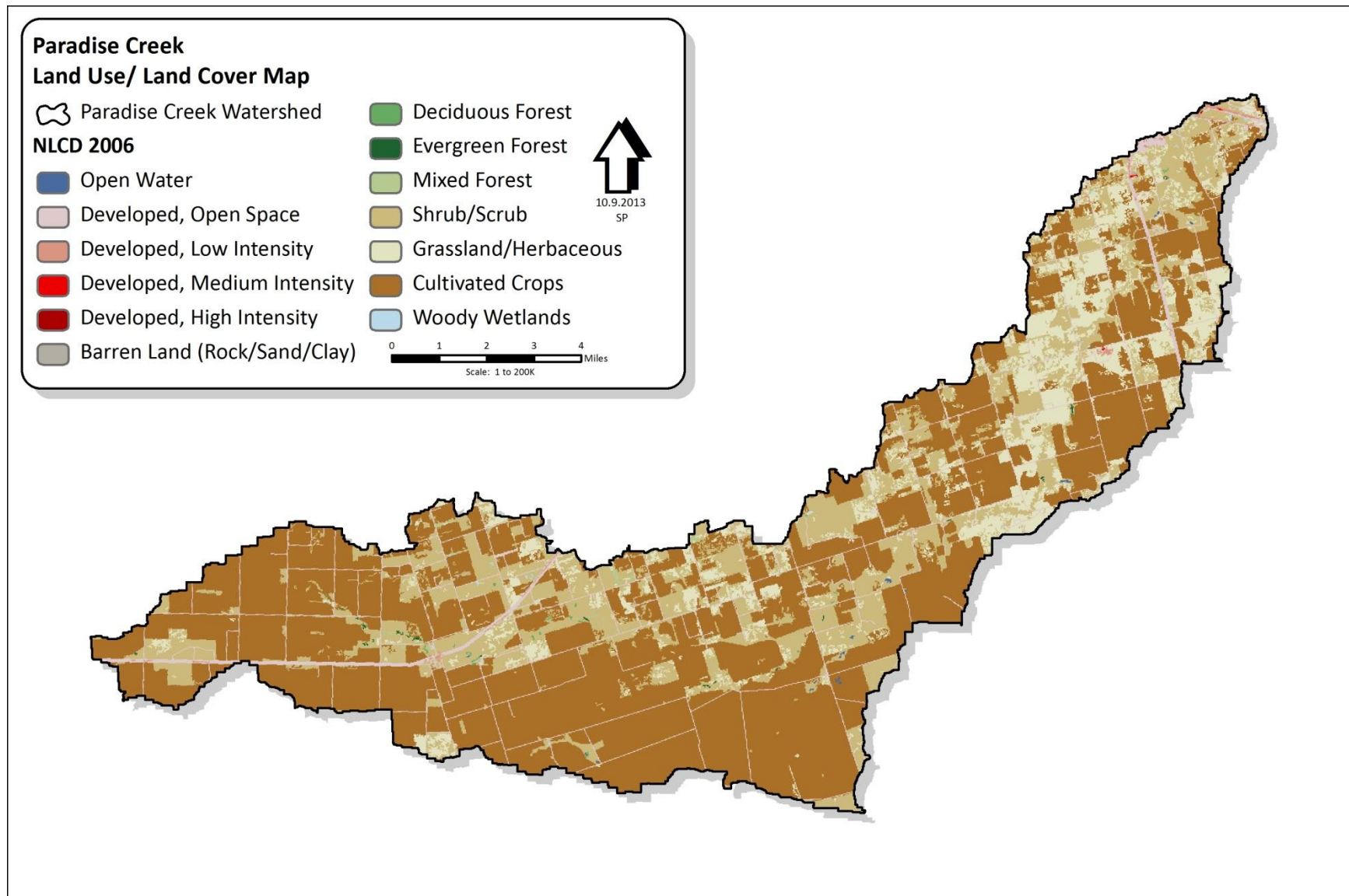


Figure 4.2 Land use/land cover for the Paradise Creek watershed. Source: 2006 National Land Cover Database (USGS, 2013).

Non-Permitted Agricultural Activities and Domesticated Animals

Activities such as livestock grazing close to waterbodies and agricultural use of manure as fertilizer, can contribute *E. coli* to nearby waterbodies. Livestock statistics were obtained from United States Department of Agriculture (USDA) National Agricultural Statistics Service website from the 2007 survey (USDA, 2007). Statistics indicated large numbers of beef cattle in both Foard and Wilbarger counties, and, thus, for the watershed (Table 4.1).

Table 4.1 Estimated livestock numbers within the Paradise Creek watershed based on statistics for Foard and Wilbarger Counties adjusted for the percent of the county within the watershed.

The Paradise Creek watershed comprises about 5.6% of Foard and 7.5% of Wilbarger County. (Source: USDA, 2007).

County	Year	Cattle & Calves (all beef)	All Goats	All Sheep	Horses & ponies	Hogs
Foard	2007	17,009	91	0	341	0
Wilbarger	2007	36,621	1,416	389	852	217
Paradise Creek Watershed Average	2007	3,670	111	29	83	16

Domestic pets are another unregulated source of *E. coli* bacteria, particularly dogs, because storm runoff often carries these wastes into streams (EPA, 2009). Assuming a rough estimate of 0.584 dogs per household (AVMA, 2012) and about 475 households within the Paradise Creek watershed based on 2010 census population data (about 950 individuals and 2 individuals per household), there are potentially about 277 dogs within the Paradise Creek watershed. Other domestic animals, such as outdoor cats, can also contribute to bacterial pollution; however, cat populations are difficult to estimate because in many rural areas, cats are often feral.

Wildlife and Feral Hogs

Other possible bacteria contributors include wildlife, such as deer, feral hogs, and birds. Between 2005 and 2012, average estimated whitetail deer densities ranged between 8.29 to 28.9 deer/1000 acres within the regional management unit encompassing the Paradise Creek watershed (TPWD, 2012). Statewide feral hog densities range from an estimated average of 1.33 to 2.45 hogs per square mile (Agrilife, 2011).

Failing On-Site Sewage Facilities Septic systems or on-site sewage facilities (OSSFs) are often used in rural areas that do not have the ability to connect to a central wastewater collection system. The 2010 U.S. Census Bureau (USCB) data indicated that of the 475 households in the Paradise Creek watershed, about 55 percent are outside municipal areas and likely on septic systems.

Historical Review

A review of historical information regarding recreational use of Paradise Creek was conducted. The review considered the time period of November 28, 1975 to the present in accordance with 40 CFR Part 131 (EPA standards regulation). Government offices, libraries, historical societies, and newspapers were searched and contacted in addition to generic internet searches. The following is a summary of the review.

Government Sources

City of Vernon

<http://www.vernontx.gov/>

The City of Vernon website included a copy of the *Park, Recreation and Open Space Master Plan for 2009*. The document included a suggestion to create a lake on Paradise Creek complete with walking trails. A swimming pool type aquatic center was decided upon in lieu of a lake on Paradise Creek. The Orbison Aquatics Center has since been built within the Vernon city limits.

City of Crowell

<http://www.crowelltex.com/>

Nothing significant was found pertaining to the historical use of Paradise Creek.

Library Sources

Carnegie City-County Library

2810 Wilbarger St

Vernon, TX 76384

Phone Number: (940) 552-2462

Website: <http://www.vernontx.gov/index.aspx?nid=169>

No significant information was found regarding recreation use of Paradise Creek.

Newspaper Source

The Vernon Record

<http://www.vernonrecord.com/17691/1854/1/todays-issuepdf>

Phone: (940) 552-5454

No significant information was found regarding recreation use of Paradise Creek.

Time Record News

<http://www.timesrecordnews.com/>

Phone: (940) 767-8341

No significant information was found regarding recreation use of Paradise Creek.

Internet Searches

The Handbook of Texas Online

<http://www.tshaonline.org/>

Searched the handbook by creek name. Nothing significant was found.

Survey Site Descriptions

For Paradise Creek, initially twenty-eight sampling sites were identified (Figure 4.1 and Table 4.2); however, site PD019 was removed from the project prior to surveying upon landowner request. Only twenty-seven sites were included in the RUAA field surveys. All access to Paradise Creek is privately owned except narrow access points at public road crossings and many are restricted by fences. Through private landowner involvement, sampling sites were established on private property at 9 locations. Access to these 9 sites on private lands are restricted by fences, locked gates, long distances from public roads, and/or required a landowner escort. An additional 18 sites were located at public road crossings, where landowner permission was not required to access the stream; however, landowner permission was requested, and attained, to conduct the entire 300-m surveys. Of note for Paradise Creek, the crossing at Farm-to-Market (FM) Road 262 in Thalia was not included as a survey site, because landowner permission could not be obtained for access beyond the immediate crossing.

Table 4.2 Description and location of RUAA field survey sites for Paradise Creek (0230A).

* indicates that the site was publically accessible at a road crossing but that further access was limited by fencing of private property.

TCEQ ID	Site ID	Site Description	Latitude	Longitude	Distance from Previous Site (mi)¹	Distance from Confluence (mi)¹	Distance from Upper Reach (mi)¹	Access
10094	PD001	Paradise Creek at US Hwy 287	34.152518	-99.245708	-	0.62	43.02	Public*
	PD002	Paradise Creek at State Loop 488, south of road	34.150771	-99.256401	0.70	1.32	42.32	Public*
	PD003	Paradise Creek at Summerour Rd, east of road	34.142409	-99.263835	0.76	2.08	41.56	Public*
	PD004	Paradise Creek at Eagle St, west of road	34.126706	-99.273206	2.21	4.29	39.35	Public*
	PD005	Paradise Creek at US Hwy 183, east of road	34.120926	-99.279594	0.84	5.13	38.51	Public*
	PD006	Paradise Creek at CR 128, south of road	34.113162	-99.282745	0.99	6.12	37.52	Public*
	PD007	Paradise Creek at old CR 99 S	34.096945	-99.289448	1.46	7.58	36.06	Private
	PD008	Paradise Creek 0.40 river miles northeast of FM 433 bridge	34.082657	-99.298264	1.48	9.06	34.58	Private

TCEQ ID	Site ID	Site Description	Latitude	Longitude	Distance from Previous Site (mi)¹	Distance from Confluence (mi)¹	Distance from Upper Reach (mi)¹	Access
17600	PD009	Paradise Creek at FM 433, north of road	34.078991	-99.301707	0.40	9.46	34.18	Public*
	PD010	Paradise Creek 0.68 river miles southwest of CR 97 S	34.071150	-99.302150	0.68	10.14	33.50	Private
	PD011	Paradise Creek at CR 134, south of road	34.063181	-99.305328	0.99	11.13	32.51	Public*
	PD012	Paradise Creek 1.5 river miles south of CR 134	34.053478	-99.315339	1.50	12.63	31.01	Private
	PD013	Paradise Creek at FM2585	34.030332	-99.318321	3.85	16.48	27.16	Public*
	PD014	Paradise Creek 1.35 river miles southeast of CR 138	34.029279	-99.340239	2.29	18.77	24.87	Private
	PD015	Paradise Creek at CR 138 west of CR 89, south of road	34.027440	-99.351650	1.35	20.12	23.52	Public*
	PD016	Paradise Creek at CR 138 near intersection with CR 85 S, north of road	34.026317	-99.355889	0.33	20.45	23.19	Public*
	PD017	Paradise Creek at CR 81, east of road	34.007302	-99.385386	3.78	24.23	19.41	Public*

TCEQ ID	Site ID	Site Description	Latitude	Longitude	Distance from Previous Site (mi)¹	Distance from Confluence (mi)¹	Distance from Upper Reach (mi)¹	Access
	PD018	Paradise Creek at CR 140, north of road	34.001297	-99.393540	1.12	25.35	18.29	Public*
	PD019	Paradise Creek at RR 1207, west of road	33.994768	-99.399824	0.75	26.1	17.54	Public*
	PD020	Paradise Creek 1.8 river miles east of CR 138	33.989388	-99.439459	2.43	28.53	15.11	Private
	PD021	Paradise Creek 1.2 river miles east of CR 138	33.989163	-99.449744	0.6	29.13	14.51	Private
	PD022	Paradise Creek at CR 138	33.992020	-99.471200	1.31	30.44	13.2	Public*
	PD023	Paradise Creek 2.23 river miles east of CR 195	33.996853	-99.486981	3.1	33.54	10.1	Private
	PD024	Paradise Creek at CR 195, west of road	33.992512	-99.508263	2.23	35.77	7.87	Public*
	PD025	Paradise Creek at US Hwy 70 east of Thalia	33.986851	-99.530203	2.01	37.78	5.86	Public*
	PD026	Paradise Creek at CR 288, west of road	33.988370	-99.543021	0.96	38.74	4.90	Public*

TCEQ ID	Site ID	Site Description	Latitude	Longitude	Distance from Previous Site (mi)¹	Distance from Confluence (mi)¹	Distance from Upper Reach (mi)¹	Access
	PD027	Paradise Creek at CR 239, east of road	33.991364	-99.558936	1.41	40.15	3.49	Public*
	PD028	Paradise Creek 1.57 river miles west of CR 239	33.98600	-99.572000	1.57	41.72	1.92	Private

Distances were digitally estimated using the measuring tool in ArcGIS 9.3 with the 2010 NAIP 1-m DOQQs and the NHD stream layer as reference guides.

Site PD001 is located on Paradise Creek 0.62 miles from the confluence with the Pease River. This site is publically accessible from the bridge at US Hwy 287. No private fencing blocked access to the creek at this location.

Site PD002 is located on Paradise Creek 1.32 miles from the confluence with the Pease River. This site is publically accessible only at the bridge on Wilbarger St with a private property fence restricting further access. Landowner permission allowing across-fence access away from the road crossing was required to complete the survey.

Site PD003 is located on Paradise Creek 2.08 miles from the confluence with the Pease River. This site is publically accessible only at the bridge at Summerour Rd with a private property fence restricting further access. Landowner permission allowing across-fence access away from the road crossing was required to complete the survey.

Site PD004 is located on Paradise Creek 4.29 miles from the confluence with the Pease River. This site is publically accessible only at the Eagle St bridge with a private property fence restricting further access. Landowner permission allowing across-fence access away from the road crossing was required to complete the survey.

Site PD005 is located on Paradise Creek 5.13 miles from the confluence with the Pease River. This site is publically accessible only at the US Hwy 183 bridge. A private property fence restricting further access was located approximately 150 m downstream from the bridge. Landowner permission allowing across-fence access away from the road crossing was required to complete the survey.

Site PD006 is located on Paradise Creek 6.12 miles from the confluence with the Pease River. This site is publically accessible only at the CR 128 bridge with a private property fence restricting further access. Landowner permission allowing across-fence access away from the road crossing was required to complete the survey.

Site PD007 is located on Paradise Creek 7.58 miles from the confluence with the Pease River. Access to this site required landowner permission through a gate onto private property and travel about 0.25 miles down a dirt road.

Site PD008 is located on Paradise Creek 9.04 miles from the confluence with the Pease River. Access to this site required landowner permission through a gate east of County Road 97 (Center Dr.). The 300-m survey reach for this site crossed over into neighboring property at two places, which required a second landowner's permission to cross fences and complete the survey.

Site PD009 is located on Paradise Creek 9.46 miles from the confluence with the Pease River. This site is publically accessible only at the bridge on FM 433 and did not have fence lines hindering completion of the survey. However, landowner permission was sought and attained prior to entering the site.

Site PD010 is located on Paradise Creek 10.14 miles from the confluence with the Pease River. Access to this site required landowner permission through a gate onto private property and travel approximately 0.25 miles down a dirt road.

Site PD011 is located on Paradise Creek 11.13 miles from the confluence with the Pease River. This site is publically accessible at the bridge on CR 134 and did not have fence lines hindering completion of the survey. However, landowner permission was sought and attained prior to entering the site.

Site PD012 is located on Paradise Creek 13.47 miles from the confluence with the Pease River off old CR 136, which is now a private road. Access to this site required landowner escort through a private gate onto private property and travel approximately 0.5 mile through pastureland.

Site PD013 is located on Paradise Creek 16.48 miles from the confluence with the Pease River. This site is publically accessible only at the bridge at FM 2585 with a private property fence restricting further access. Landowner permission allowing across-fence access away from the road crossing was required to complete the survey.

Site PD014 is located on Paradise Creek 18.77 miles from the confluence with the Pease River. Access to this site required landowner permission to enter through a locked gate onto private property and travel approximately 100m.

Site PD015 is located on Paradise Creek 20.12 miles from the confluence with the Pease River. This site is publically accessible at the bridge on CR 138. A power transmission line road also exits at this location. Landowner permission was still sought and attained prior to entering the site.

Site PD016 is located on Paradise Creek 20.62 miles from the confluence with the Pease River. This site is publically accessible at the bridge on CR 138, a transmission line road, and an oil and gas road. Landowner permission was still sought and attained prior to entering the site.

Site PD017 is located on Paradise Creek 24.23 miles from the confluence with the Pease River. Although this site is listed as publically accessible, access is significantly limited because the private property fencing comes up and meets the bridge on CR 81. Landowner permission was still sought and attained prior to entering the site.

Site PD018 is located on Paradise Creek 25.35 miles from the confluence with the Pease River. Although this site is listed as publically accessible, access is significantly limited because the private property fencing comes up and meets the bridge on CR 140. Landowner permission was still sought and attained prior to entering the site.

Site PD019 is located on Paradise Creek 26.1 miles from the confluence with the Pease River. This site was removed from the RUAA list after initial approval because the landowner withdrew access.

Site PD020 is located on Paradise Creek 28.53 miles from the confluence with the Pease River. Access to this site required landowner permission to enter through a private gate with cattle guard and to travel approximately 0.5 miles.

Site PD021 is located on Paradise Creek 29.13 miles from the confluence with the Pease River. Access to this site required landowner permission to enter through a private gate with electric fence and to travel approximately 0.5 miles.

Site PD022 is located on Paradise Creek at CR 138. This site is publically accessible at the road crossing however required crossing a fence line onto private property to complete the survey. Landowner permission was sought and attained prior to entering the site.

Site PD023 is located on Paradise Creek 33.54 miles from the confluence with the Pease River. Access to this site required landowner permission to enter through a private gate and to travel approximately 0.25 mile.

Site PD024 is located on Paradise Creek 35.77 miles from the confluence with the Pease River. This site is publically accessible only at the bridge on CR 195 with a private property fence restricting further access. Landowner permission allowing across-fence access away from the road crossing was required to complete the survey.

Site PD025 is located on Paradise Creek 37.78 miles from the confluence with the Pease River. This site is publically accessible at the bridge on US Hwy 70, however, access is significantly limited because the private property fencing comes up to the bridge. Landowner permission allowing access through a closed gate onto private property was required to complete the survey.

Site PD026 is located on Paradise Creek 38.74 miles from the confluence with the Pease River. This site is publically accessible at the bridge on CR 288 and a transmission line road. The site did not have fence lines hindering completion of the survey. Landowner permission allowing access away from the road crossing was still sought and obtained prior to conducting the survey.

Site PD027 is located on Paradise Creek 40.15 miles from the confluence with the Pease River. This site is publically accessible only at the bridge on CR 239 with a private property fence restricting further access. Landowner permission allowing across-fence access away from the road crossing was required to complete the survey.

Site PD028 is located on Paradise Creek 41.72 miles from the confluence with the Pease River. Access to this property required landowner permission to enter through a private gate onto private property and travel approximately 0.5 miles.

Field Survey Results and Discussions

General Description of RUAA Survey Sites and Conditions for Paradise Creek (0230A)

The Paradise Creek RUAA surveys were conducted on June 9-11 and 14, 2013 and August 11-13, 2013 at all 27 sites. The surveys and associated interviews were performed on weekdays, weekends, or holidays at opportune times to observe recreational activities in and Paradise Creek. Surveys were conducted during varying air temperatures as shown in Table 4.3 and 4.4. Air temperatures during both surveys were above 21°C (70°F) indicated by the RUAA guidelines as warm enough to promote recreational activities. During the 30 days prior to the first RUAA survey a total of 1.13 inches of rain was recorded (Table 4.3), while prior to the second survey starting on August 11, 2013, 4.54 inches of rain was recorded, most of which occurred on July 16,

2013 (Table 4.4). The Palmer Drought Index estimated the region to be in severe and moderate drought for the first and second RUAA surveys respectively (TWDB, 2013).

A summary of the RUAA field survey results is presented in the following tables:

Table 4.5 describes the stream channel and corridor characteristics at each site.

Table 4.6 notes the average thalweg depth by site during each survey and the access to the stream, whether public or private, and the ease of bank access.

Tables 4.7 and 4.8 document the maximum, minimum, and average stream widths at each site for each survey and observed flow conditions.

Tables 4.9 and 4.10 note stream aesthetics, wildlife observations and tracks, and the presence of garbage observed at each site during each survey.

Physical descriptions of each site follow these tables along with selected photos showing notable characteristics of each site. Overall thalweg depth averaged 0.01 m during the first survey and 0.05 m during the second survey. Access to the stream down the bank was moderately easy as the banks were not very steep and vegetation generally did not impede travel. The dominant substrate was mud/clay and the stream corridor was largely lined with pasture and shrubs. The maximum stream width was 15 m during the first survey in June 2013 and 18 m during the second survey in August. No flow or dry conditions were encountered throughout the segment during both surveys. Water when encountered was generally brown in color. In general, the majority of observed tracks and fecal droppings reported were from wildlife, although cow manure was observed at select sites and cattle were observed near the creek. Tracks observed most often included raccoon, deer, hogs and livestock. Observed trash was predominantly plastics, glass bottles and aluminum cans, and was most common at bridge crossings. Trash on private lands was rare and appeared to have washed in during high flow periods.

**Table 4.3 Rainfall records with maximum and minimum temperature for Vernon, Texas
30 days prior to the first RUAA survey initiated on June 9, 2013.**

Survey dates are shaded in grey. Data obtained from the Weather Underground for Vernon, TX Airport weather station KFO5.

Date	Daily Precipitation (in)	Maximum Daily Temperature (°F)	Minimum Daily Temperature (°F)
10-May-13	0.03	83	56
11-May-13	0	84	49
12-May-13	0	84	46
13-May-13	0	94	56
14-May-13	0	94	59
15-May-13	0.04	87	66
16-May-13	0	85	62
17-May-13	0	96	67
18-May-13	0	103	69
19-May-13	0	103	73
20-May-13	0	100	66
21-May-13	0.22	79	58
22-May-13	0	92	52
23-May-13	0	90	64
24-May-13	0	93	65
25-May-13	0	90	66
26-May-13	0	96	70
27-May-13	0	98	73
28-May-13	0	85	77
29-May-13	0.02	90	74
30-May-13	0	101	76
31-May-13	0	107	75
1-Jun-13	0	91	68
2-Jun-13	0	86	61
3-Jun-13	0	97	65
4-Jun-13	0	-	-
5-Jun-13	0	91	78
6-Jun-13	0.82	81	65
7-Jun-13	0	86	61

Date	Daily Precipitation (in)	Maximum Daily Temperature (°F)	Minimum Daily Temperature (°F)
8-Jun-13	0	92	65
9-Jun-13	0.15	92	64
10-Jun-13	0	102	69
11-Jun-13	0	99	71
12-Jun-13	0	101	71
13-Jun-13	0	100	69
14-Jun-13	0	96	69

Table 4.4 Rainfall records with maximum and minimum temperature for Vernon, Texas 30 days prior to the second RUAA survey initiated on August 11, 2013.

Survey dates are shaded in grey. Data obtained from Weather Underground for Vernon, TX Airport weather station KFO5.

Date	Daily Precipitation (in)	Maximum Daily Temperature (°F)	Minimum Daily Temperature (°F)
10-Jul-13	0	103	79
11-Jul-13	0	105	78
12-Jul-13	0	104	77
13-Jul-13	0	106	78
14-Jul-13	0.27	106	66
15-Jul-13	0.12	106	64
16-Jul-13	3.0	76	68
17-Jul-13	0.19	86	70
18-Jul-13	0	91	70
19-Jul-13	0	94	71
20-Jul-13	0	97	73
21-Jul-13	0	98	73
22-Jul-13	0	98	78
23-Jul-13	0	99	79
24-Jul-13	0	99	75
25-Jul-13	0.65	87	72
26-Jul-13	0.19	88	75
27-Jul-13	0	91	68
28-Jul-13	0	92	68
29-Jul-13	0	95	77
30-Jul-13	0	98	77
31-Jul-13	0	100	77

Date	Daily Precipitation (in)	Maximum Daily Temperature (°F)	Minimum Daily Temperature (°F)
1-Aug-13	0.04	100	75
2-Aug-13	0	105	79
3-Aug-13	0	104	79
4-Aug-13	0	101	77
5-Aug-13	0	104	79
6-Aug-13	0	106	76
7-Aug-13	0	101	76
8-Aug-13	0.08	100	74
9-Aug-13	0	93	69
10-Aug-13	0	91	71
11-Aug-13	0	98	70
12-Aug-13	0.26	100	75
13-Aug-13	0	89	73

Table 4.5 Stream Channel and corridor appearance for each site sampled along Paradise Creek (0230A).

Site Number	Stream Channel Appearance	Dominant Substrate	Corridor Appearance	Riparian Size	Park	Landscape Surroundings
PD001	Natural	Mud/clay	Pasture	Large	No	Native
PD002	Natural	Silt	Pasture	Large	No	Native
PD003	Natural	Mud/clay/rip rap	Pasture	Large	No	Native
PD004	Natural	Mud/clay	Pasture	Large	No	Native
PD005	Natural	Mud/clay	Pasture	Large	No	Native
PD006	Natural	Mud/clay	Shrub	Large	No	Native
PD007	Natural	Mud/clay	Pasture	Large	No	Native/improved
PD008	Natural	Sand	Shrub/pasture	Large	No	Native
PD009	Natural	Mud/clay	Shrub	Large	No	Native
PD010	Natural	Mud/clay	Shrub/pasture	Large	No	Native/improved
PD011	Natural	Mud/clay	Pasture	Large	No	Native
PD012	Natural	Mud/clay	Shrub	Large	No	Native
PD013	Natural	Mud/clay	Pasture	Large	No	Native
PD014	Natural	Mud/clay	Shrub	Large	No	Improved
PD015	Natural	Sand	Shrub	Large	No	Native
PD016	Natural	Mud/clay	Shrub/pasture	Large	No	Native
PD017	Natural	Mud/clay/sand	Pasture	Large	No	Improved
PD018	Natural	Mud/clay	Shrub	Large	No	Improved
PD019	N/A	N/A	N/A	N/A	No	N/A
PD020	Natural	Mud/clay	Pasture	Large	No	Native
PD021	Natural	Mud/clay/sand	Pasture	Large	No	Improved

Site Number	Stream Channel Appearance	Dominant Substrate	Corridor Appearance	Riparian Size	Park	Landscape Surroundings
PD022	Natural	Mud/clay	Shrub/pasture	Large	No	Native/improved
PD023	Natural	Mud/clay	Forest/shrub	Large	No	Native
PD024	Natural	Mud/clay	Shrub	Large	No	Native
PD025	Natural	Mud/clay	Shrub	Large	No	Native
PD026	Natural	Mud/clay	Shrub	Large	No	Native
PD027	Natural	Mud/clay	Shrub	Large	No	Native
PD028	Natural	Mud/clay	Pasture	Large	No	Native/improved

Table 4.6 Thalweg depth, stream flow type, and site accessibility during the two surveys of Paradise Creek (0230A).

Stream flow type represents TCEQ descriptions (TCEQ, 2012). Under general access, * indicates that the site was publically accessible at a road crossing but that further access was limited by fencing of private property. For bank access, E = Easy, ME = Moderately Easy, MD = Moderately Difficult, and D = Difficult.

Site	Segment length (m)	# of Transects	# of Recreational Areas at Site	Avg. Site Thalweg Depth (m) for Trip 1	Avg. Site Thalweg Depth (m) for Trip 2	Stream Flow Type	General Access	Bank Access
PD001	300	11	0	0.03	0.24	Intermittent with Pools	Public*	ME
PD002	300	11	0	0.00	0.00	Intermittent with Pools	Public*	ME
PD003	300	11	0	0.03	0.16	Intermittent with Pools	Public*	MD
PD004	300	11	0	0.00	0.00	Intermittent with Pools	Public*	ME
PD005	300	11	0	0.00	0.29	Intermittent with Pools	Public*	ME
PD006	300	11	0	0.00	0.08	Intermittent with Pools	Public*	ME
PD007	300	11	0	0.28	0.37	Intermittent with Pools	Private	MD
PD008	300	11	0	0.00	0.00	Intermittent with Pools	Private	E
PD009	300	11	0	0.00	0.00	Intermittent with Pools	Public*	ME
PD010	300	11	0	0.00	0.00	Intermittent with Pools	Private	ME
PD011	300	11	0	0.00	0.00	Intermittent with Pools	Public*	ME
PD012	300	11	0	0.00	0.00	Intermittent with Pools	Private	E

Site	Segment length (m)	# of Transects	# of Recreational Areas at Site	Avg. Site Thalweg Depth (m) for Trip 1	Avg. Site Thalweg Depth (m) for Trip 2	Stream Flow Type	General Access	Bank Access
PD013	300	11	0	0.00	0.00	Intermittent with Pools	Public*	ME
PD014	300	11	0	0.00	0.03	Intermittent with Pools	Private	E
PD015	300	11	0	0.00	0.00	Intermittent with Pools	Public*	MD
PD016	300	11	0	0.00	0.00	Intermittent with Pools	Private	MD
PD017	300	11	0	0.01	0.00	Intermittent with Pools	Public*	E
PD018	300	11	0	0.00	0.00	Intermittent with Pools	Public*	ME
PD019	N/A	N/A	0	N/A	N/A	Intermittent with Pools	Public*	-
PD020	300	11	0	0.00	0.00	Intermittent with Pools	Private	ME
PD021	300	11	0	0.00	0.00	Intermittent with Pools	Private	ME
PD022	300	11	0	0.00	0.00	Intermittent with Pools	Public*	E
PD023	300	11	0	0.00	0.00	Intermittent with Pools	Private	ME
PD024	300	11	0	0.00	0.00	Intermittent with Pools	Public*	ME
PD025	300	11	0	0.01	0.03	Intermittent with Pools	Public*	E
PD026	300	11	0	0.00	0.02	Intermittent with Pools	Public*	MD
PD027	300	11	0	0.00	0.00	Intermittent with Pools	Public*	ME

Site	Segment length (m)	# of Transects	# of Recreational Areas at Site	Avg. Site Thalweg Depth (m) for Trip 1	Avg. Site Thalweg Depth (m) for Trip 2	Stream Flow Type	General Access	Bank Access
PD028	300	11	0	0.00	0.00	Intermittent with Pools	Private	E

Table 4.7 Description of surveyed stream sites along Paradise Creek during first survey performed the week of June 9, 2013.

Site Number	Maximum Width (m)	Minimum Width (m)	Typical Average Width (m)	Observed Flow
PD001	3.4	0	0	No flow
PD002	0	0	0	Dry
PD003	0.28	0	0	No flow
PD004	0	0	0	Dry
PD005	0	0	0	Dry
PD006	0	0	0	Dry
PD007	15	0	8.0	No flow
PD008	0	0	0	Dry
PD009	0	0	0	Dry
PD010	0	0	0	Dry
PD011	0	0	0	Dry
PD012	0	0	0	Dry
PD013	0	0	0	Dry
PD014	0	0	0	Dry
PD015	0	0	0	Dry
PD016	0	0	0	Dry
PD017	8.0	0	0	No flow
PD018	0	0	0	Dry
PD019	N/A	N/A	N/A	N/A
PD020	0	0	0	Dry
PD021	0	0	0	Dry
PD022	0	0	0	Dry
PD023	0	0	0	Dry
PD024	0	0	0	Dry
PD025	2.8	0	0	No flow
PD026	0	0	0	Dry
PD027	0	0	0	Dry
PD028	0	0	0	Dry

Table 4.8 Description of surveyed stream sites along Paradise Creek during second survey performed August 11-13, 2013.

Site Number	Maximum Width (m)	Minimum Width (m)	Typical Average Width (m)	Observed Flow
PD001	5.5	0	2.5	No flow
PD002	0	0	0	Dry
PD003	9.0	0	0	No flow
PD004	0	0	0	Dry
PD005	9.5	0	7.0	No flow
PD006	3.5	0	0	No flow
PD007	18	0	10	No flow
PD008	0	0	0	Dry
PD009	0	0	0	Dry
PD010	0	0	0	Dry
PD011	0	0	0	Dry
PD012	0	0	0	Dry
PD013	0	0	0	Dry
PD014	2.8	0	0	No flow
PD015	0	0	0	Dry
PD016	0	0	0	Dry
PD017	0	0	0	Dry
PD018	0	0	0	Dry
PD019	N/A	N/A	N/A	N/A
PD020	0	0	0	Dry
PD021	0	0	0	Dry
PD022	0	0	0	Dry
PD023	0	0	0	Dry
PD024	0	0	0	Dry
PD025	3.0	0	0	No flow
PD026	3.0	0	0	No flow
PD027	0	0	0	Dry
PD028	0	0	0	Dry

Table 4.9 Stream aesthetics along Paradise Creek during first survey performed the week of June 9, 2013.

A = absent, R = rare, C = common, Ab = abundant, N = none, NW = no water, SP = slight presence, MP = moderate presence, LP = large presence from Field Data Sheet – Sect. F.

Site	Aquatic Vegetation	Algae Cover	Odor	Color	Bottom Deposit	Water Surface	Reptiles	Water Dependent Birds	Mammals	Evidence of wildlife	Large garbage in Channel	Small garbage in Channel	Bank garbage
PD001	A	A	R	clear	Fine sediment	clear	N	N	N	Tracks, fecal	R	R	R
PD002	A	A	R	NW	Fine sediment	NW	SP	N	N	Tracks, fecal	N	R	N
PD003	A	A	C	Green	Fine sediment	Clear	N	N	SP	Tracks, fecal	N	N	N
PD004	A	A	N	NW	Fine sediment	NW	N	N	N	Tracks, fecal	N	C	R
PD005	A	A	N	NW	Fine sediment	NW	N	N	N	Tracks, fecal	R	R	N
PD006	A	A	N	NW	Fine sediment	NW	N	N	N	Tracks, fecal	N	R	N
PD007	C	R	N	Brown	Fine sediment	Clear	N	SP	N	Tracks, fecal	R	R	R
PD008	A	A	NW	NW	Fine sediment	NW	N	N	SP	Fecal	R	C	R
PD009	A	A	N	NW	Fine sediment	NW	N	N	SP	Tracks, fecal	N	C	R
PD010	A	A	N	NW	Fine sediment	NW	N	N	SP	Tracks, fecal	C	R	R

Site	Aquatic Vegetation	Algae Cover	Odor	Color	Bottom Deposit	Water Surface	Reptiles	Water Dependent Birds	Mammals	Evidence of wildlife	Large garbage in Channel	Small garbage in Channel	Bank garbage
PD011	A	A	NW	NW	Fine sediment	NW	N	N	SP	Tracks, fecal	N	R	R
PD012	A	A	NW	NW	Fine sediment	NW	N	N	SP	Tracks, fecal	N	N	N
PD013	A	A	NW	NW	Fine sediment	NW	N	N	SP	Tracks, fecal	C	R	N
PD014	A	A	NW	NW	Fine sediment	NW	N	N	SP	Tracks, fecal	R	R	N
PD015	NW	NW	NW	NW	Fine Sediment	NW	N	N	SP	Tracks, fecal	R	A	R
PD016	NW	NW	NW	NW	Fine sediment	NW	N	N	N	Tracks, fecal	R	R	R
PD017	NW	NW	NW	NW	Fine sediment/solids	NW	N	N	N	Tracks, fecal	R	R	R
PD018	NW	NW	NW	NW	Fine sediment	NW	N	N	SP	Tracks, fecal	R	R	N
PD019	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A
PD020	NW	NW	NW	NW	Fine sediment	NW	N	N	N	Tracks, fecal	R	R	N
PD021	NW	NW	NW	NW	Fine sediment	NW	N	N	N	Tracks, fecal	R	R	N
PD022	NW	NW	NW	NW	Fine sediment	NW	N	N	N	Tracks, fecal	N	R	N

Site	Aquatic Vegetation	Algae Cover	Odor	Color	Bottom Deposit	Water Surface	Reptiles	Water Dependent Birds	Mammals	Evidence of wildlife	Large garbage in Channel	Small garbage in Channel	Bank garbage
PD023	NW	NW	NW	NW	Fine sediment	NW	N	N	N	Tracks, fecal	N	N	N
PD024	NW	NW	NW	NW	Fine sediment	NW	N	N	SP	Tracks, fecal	R	N	N
PD025	A	A	N	Green	Fine sediment	Scum, foam	N	N	N	Tracks, fecal	N	R	R
PD026	NW	NW	NW	NW	Fine sediment	NW	N	N	N	Tracks, fecal	R	R	R
PD027	NW	NW	NW	NW	Fine sediment	NW	N	N	SP	Tracks, fecal	N	R	N
PD028	NW	NW	NW	NW	Fine sediment	NW	N	N	N	Tracks, fecal	N	R	N

Table 4.10 Stream aesthetics along Paradise Creek during second survey performed August 2013.

A = absent, R = rare, C = common, Ab = abundant, N = none, NW = no water, SP = slight presence, MP = moderate presence, LP = large presence from Field Data Sheet – Sect. F.

Site	Aquatic Vegetation	Algae Cover	Odor	Color	Bottom Deposit	Water Surface	Reptiles	Water Dependent Birds	Mammals	Evidence of wildlife	Large garbage in Channel	Small garbage in Channel	Bank garbage
PD001	R	C	N	Clear/brown	Fine sediment	Clear	N	N	N	Tracks, fecal	N	R	R
PD002	R	A	R	NW	Fine sediment/solids	NW	N	N	N	Tracks, fecal	N	R	N
PD003	A	A	N	Brown	Fine sediment, other	Clear	SP	N	SP	Tracks, fecal	R	R	N
PD004	A	A	NW	NW	Fine sediment	NW	N	N	N	Tracks, fecal	N	C	N
PD005	A	C	R	Clear/Brown	Fine sediment	Scum	SP	SP	N	Tracks, fecal	N	R	R
PD006	A	A	N	Brown	Fine sediment	Clear	N	N	N	Tracks, fecal	R	R	N
PD007	A	A	N	Brown	Fine sediment	Clear	N	N	SP	Tracks, fecal, sight	R	N	R
PD008	A	A	N	NW	Fine sediment	NW	N	N	N	Tracks, fecal	R	R	R
PD009	A	A	NW	NW	Fine sediment	NW	N	N	SP	Tracks, fecal	R	C	N
PD010	A	A	NW	NW	Fine sediment	NW	N	N	SP	Tracks, fecal	R	R	N

Site	Aquatic Vegetation	Algae Cover	Odor	Color	Bottom Deposit	Water Surface	Reptiles	Water Dependent Birds	Mammals	Evidence of wildlife	Large garbage in Channel	Small garbage in Channel	Bank garbage
PD011	A	A	NW	NW	Fine sediment	NW	N	N	N	Tracks, fecal	N	R	R
PD012	A	A	NW	NW	Fine sediment	NW	N	N	SP	Tracks, fecal	N	N	N
PD013	A	A	NW	NW	Fine sediment	NW	N	N	SP	Tracks, fecal	C	C	R
PD014	A	C	N	Brown	Fine sediment	Clear	N	N	N	Tracks, fecal	R	R	N
PD015	NW	NW	NW	NW	Fine sediment	NW	N	N	N	Tracks, fecal	A	R	R
PD016	NW	NW	NW	NW	Fine sediment	NW	N	N	N	Fecal, tracks	R	C	R
PD017	NW	NW	NW	NW	Fine sediment	NW	SP	SP	N	Fecal, tracks	R	R	N
PD018	NW	NW	NW	NW	Fine sediment	NW	N	N	N	Tracks, Fecal	R	R	N
PD019	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A
PD020	NW	NW	NW	NW	Fine sediment	NW	N	N	N	Tracks, fecal	N	R	N
PD021	NW	NW	NW	NW	Fine sediment	NW	N	N	N	Tracks, fecal	R	R	N
PD022	NW	NW	NW	NW	Fine sediment	NW	N	N	SP	Tracks, fecal	N	R	N

Site	Aquatic Vegetation	Algae Cover	Odor	Color	Bottom Deposit	Water Surface	Reptiles	Water Dependent Birds	Mammals	Evidence of wildlife	Large garbage in Channel	Small garbage in Channel	Bank garbage
PD023	NW	NW	NW	NW	Fine sediment	NW	N	N	SP	Tracks, fecal	N	R	N
PD024	NW	NW	NW	NW	Fine sediment	NW	N	N	N	Tracks, fecal	N	N	N
PD025	A	R	N	Brown	Fine sediment	Scum	N	N	N	Tracks, fecal	N	R	R
PD026	A	C	R	Brown	Fine sediment	Scum	N	N	N	Tracks, fecal	N	R	R
PD027	NW	NW	NW	NW	Fine sediment	NW	N	N	SP	Tracks, fecal	R	R	N
PD028	NW	NW	NW	NW	Fine sediment	NW	SP	N	SP	Tracks, fecal	N	R	N

Physical Description of PD001

Site PD001 was surveyed June 9 and August 11, 2013. Access to this site was moderately easy as it was located at State Highway 287, which has a wide shoulder and no private fencing to cross (Figure 4.6). The primary hindrance was the muddy substrate making wading slightly difficult (Table 4.5).



Figure 4.3 Photograph of PD001 taken on August 11, 2013 of public access point at the creek and Hwy 287.

The stream was wadeable in that the water was shallow and not flowing during either survey. Thalweg depths averaged 0.03 m for trip 1 and 0.24 m for trip 2 (Table 4.6). Two pools were observed during the second survey. One measured 26-m long, 11-m wide and 0.51-m deep. The other pool measured 15-m long, 4.3-m wide and 0.45-m deep. No water was present under the bridge at the road crossing (Tables 4.7 and 4.8).

The stream channel was well defined and naturally vegetated. Banks were steep and vegetated with switchgrass on the right bank, some trees on the left with pasture out away from the stream (Figure 4.4). The fine sediment substrate was slick when wet and caused sinking when wading in places. During the first survey, where water was present, the surface was clear of algae, clear in color with an occasionally detectable odor (Table 4.9). During the second survey, there was more water in the form of small pools. The surfaces of these pools were clear and brown in color with some algae, foam and scum. An oily sheen was observed in small amounts in a few places where water was present (Table 4.10).



Figure 4.4 Photograph of site PD001 taken June 9, 2013, upstream view at 300-m transect. Note steep banks dominated by dense switchgrass.

Evidence of wildlife observed included tracks of raccoon, wading bird, canine, armadillo, turtle, and house cat in addition to tadpoles, minnows, and shells of bivalves in the water. Fecal material from cat, canine and bird were observed. Cliff swallow nests were also observed under the SH 287 bridge and consequently, their droppings (Figure 4.5). Presence of garbage at this site was rare and found, primarily, at the bridge (Tables 4.9 and 4.10). Part of a discarded bathtub was the largest garbage seen along with aluminum cans, plastic and glass bottles, styrofoam, tires, paper, cardboard, and an old shoe (Figure 4.6). All-terrain vehicle tracks were seen in the streambed approximately 50m from the bridge during the first survey. No other indications of human recreation were observed.



Figure 4.5 Photograph of site PD001 taken August 11, 2013 of bathtub and aluminum can garbage.



Figure 4.6 Photograph of PD001 taken on August 11, 2013 of cliff swallow nests under Hwy 287 bridge.

Physical Description of PD002

This site was surveyed on June 9 and August 11, 2013. Public access at the bridge made entering the stream moderately easy (Table 4.6). However, crossing a private fence through a large accumulation of debris in the stream bed within the first 30 m created an initial challenge to complete the 300-m survey (Figure 4.7). Average thalweg depths of the reach were 0.00 m during the first survey and 0.00 m during the second survey (Table 4.6).



Figure 4.7 Photograph of PD002 taken on June 9, 2013. Downstream view at the 30-m transect. Note the public access point at the bridge and debris piled up at the private fence line.

The remainder of the survey was easy because the entire 300 m was dry with a smooth substrate (Figure 4.8). Short vegetation grew in the bottom of the stream bed with an occasional tree. Banks were steep with a few locations where livestock trails created a path from the upland pasture land on both sides down through the creek bed. Cattle tracks and fecal material were observed as were bird droppings, crawdad burrows, and a dead minnow. Wildlife presence was indicated by tracks of water bird, fox, bobcat, deer, raccoon and canine. A bull snake (*Pituophis* sp.) was encountered during the first survey. Between the 30-m and 150-m transects a concrete culvert was observed in the left bank. According to the landowner, the culvert had washed out from an old road. Garbage was rare at this site and concentrated primarily at the bridge crossing (Tables 4.9 and 4.10). Aluminum cans, food wrapper, bottles, cardboard, and discarded fish heads were among the garbage observed. Occasionally throughout the survey the odor of dead carcass was encountered. No evidence of human recreation was observed at this site.



Figure 4.8 Photograph of PD002 taken on August 11, 2013. Downstream view at 300-m transect. Note the steep banks, lack of water, and cardboard garbage.

Physical Description of PD003

PD003 was surveyed on June 9 and August 11, 2013. Access to this site was easy because it occurred at a road crossing. However, access into the stream was moderately difficult because it required crossing over a private fence that bisected the creek (Table 4.6). Additionally, this site had excessive amounts of rip-rap, discarded concrete and other construction garbage strewn throughout the streambed and along the banks which made traveling the 300 m transect challenging.

This site was wadeable and in a state of no flow during both surveys (Table 4.7 and 4.8). Three pools were observed during the two surveys; one pool during the first survey and two at the second. Pool measurements ranged from 12-m long, 4-m wide and 0.7-m deep to 25-m long, 6-m wide and 0.6-m deep. Other additional pockets of water did exist but did not meet the requirements for pool designation being at least 10-m long and 0.5-m deep. Average thalweg depths of the reach were 0.03 m during the first survey and 0.16 m during the second survey (Table 4.6).

The dominant substrate of this stretch was fine sediment littered with excessive amounts of rip-rap, concrete, bricks, rebar and other discarded construction materials (Figure 4.9). This material also existed along the banks. Water surfaces during the both surveys had a scum layer (Tables 4.9 and 4.10). Water coloration changed from green during the first survey to brown during the second.



Figure 4.9 Photograph taken of PD003 on June 9, 2013. Photograph is of a pocket of water at about the 185-m transect. Note copious amounts of concrete debris, discarded hay bale and scum on water surface.

The banks were steep in some places and vegetated with switchgrass, willow trees and some cottonwoods opening up to pastureland past the edges of the riparian area (Figure 4.10). Some stretches of the stream bottom were vegetated with grasses as well. Evidence of beaver was observed in the form of gnaw marks on trees. A dead snake and shells of bivalves were seen. Horse and bird manure as well as tracks of raccoon, deer, and dog were observed in the stream bed. Garbage was rare at this site and included a tractor tire (Figure 4.11), some aluminum cans, and bottles (Tables 4.9 and 4.10). No evidence of human recreation was observed at this site.



Figure 4.10 Photograph taken of PD003 on August 11, 2013. Downstream view at the 30-m transect. Note vegetated streambed, steep right bank.



Figure 4.11 Photograph take of PD003 on August 11, 2013. Note tractor tire and brick debris.

Physical Description of PD004

PD004 was surveyed on June 9 and August 11, 2013. Access to this site was only public from the Eagle Street bridge. Getting down to the creek bed was moderately difficult because of riprap on banks, barbed wire fence, unstable log jam accumulations and a substantial steel and pipe water gap which hindered travel through the corridor (Table 4.6 and Figure 4.12). Additionally, once in the stream bed, extremely dense vegetation made traversing the entire 300-m stretch challenging.



Figure 4.12 Photograph taken on June 9, 2013. Public access of the Eagle Street bridge. Note the rip-rap, barbed wire fence, heavy steel and pipe water gap and unstable log jams.

This site was dry during both surveys with average thalweg depths of the reach being 0.00 m during the first survey and 0.00 m during the second survey (Tables 4.6, 4.7 and 4.8). Primary substrate was fine sediment. The corridor of this site was dominated by willow trees, giant ragweed over 6-ft tall in places, wild rye and multiple log jams (Figure 4.13). Outside the riparian corridor was pastureland. Presence of wildlife was indicated by deer, bird and canine tracks, crawdad burrow and a turtle shell. Garbage was common in the creek bed (Figure 4.14) and increased in occurrence with increased distance from bridge (Tables 4.9 and 4.10). Household trash was the dominant type with glass bottles, broken skylight, discarded child's stroller, toilet seat, and numerous beer cans concentrated in one place. Other garbage included pieces of metal, broken glass, oil bucket, tarp, and tire. Discarded fish carcasses were also found at the bridge. No evidence of human recreation was observed.



Figure 4.13 Photograph of PD004 taken on June 9, 2013. Downstream view at 150-m transect. Note dense vegetation throughout corridor.



Figure 4.14 Photograph of PD004 taken on August 11, 2013. Note concentration of garbage in streambed and log jam debris.

Physical Description of PD005

This site was surveyed on June 9 and August 11, 2013. Access was public at the bridge and continued downstream approximately 150 m before a private property fence restricted further access (Figure 4.15). Stream bank access was moderately easy at the bridge and traveling through this portion of the creek was also moderately easy, however banks were steep for the majority of the 300-m survey (Table 4.6).



Figure 4.15 Photograph of PD005 taken August 11, 2013 of public access point at the Hwy 183 bridge.

This site was dry during the first survey and had no flow during the second survey (Table 4.7 and 4.8). Water was encountered during the second survey but was not flowing and was never deep enough to qualify as a pool. Average thalweg depths of the reach were 0.00 m during the first survey and 0.29 m during the second survey (Table 4.6). Widths of the water reported averaged 0.0 m during the first survey and 7.0 m during the second (Tables 4.7 and 4.8).

The dominant substrate at this site was fine sediment. The water encountered during the second survey had a scum on the surface and was a brown color (Figure 4.16). Algae cover was also present during the second survey. The banks were vegetated with pasture beyond the riparian area on both the right and left sides of the stream (Table 4.5 and Figure 4.17). Vegetation at the bridge was slightly more dense and dominated by salt cedars (Figure 4.18).



Figure 4.16 Photograph of PD005 taken on August 11, 2013. Downstream 300-m transect. Note the surface scum.



Figure 4.17 Photograph of PD005 taken on June 9, 2013. Upstream view of the 30-m transect.



Figure 4.18 Photograph of PD005 taken on August 11, 2013. Downstream view at the 150-m transect. Note the steep, vegetated banks, water gap and presence of water.

Evidence of wildlife included tracks of raccoon, turtle, deer, canine, and hog. A dead snapping turtle, live red-eared sliders, a water snake, canine feces, and shells of bivalves were also observed. The squeaking of field mice in the pasture could also be heard from the stream. Garbage was present yet rare, and the majority of garbage seen was at the Hwy 183 bridge. Types of garbage included a discarded pet carrier, glass and plastic bottles, pieces of Styrofoam, food wrappers, feed bags, and a discarded animal carcass in a trash bag (Tables 4.9 and 4.10). No evidence of human recreation was observed.

Physical Description of PD006

PD006 was surveyed on June 9 and August 13, 2013. Access to this site was moderately easy as it was located at the County Road 128 bridge. However, entering the stream at this site is only publically accessible from the bridge itself. A private property fence comes up and meets the bridge then restricts further stream access as it bisects the creek as well (Table 4.6 and Figure 4.19). Traveling the creek was also moderately easy as it had little to no water and was relatively free of dense vegetation or debris. A large debris pile had accumulated at the bridge between surveys but did not cause a hindrance for the second survey (Figure 4.20).

This site was wadeable. It was dry during the first survey but did have some pockets of water during the second survey. Average thalweg depth during the second survey was 0.08 m (Table 4.6). The width at the widest point was 3.5 m; however, the majority of the stretch did not have any measureable water (Table 4.8).



Figure 4.19 Photograph of PD006 taken on August 11, 2013. Downstream view of the 30-m transect. Note private fence connecting with the bridge, hindering public access.



Figure 4.20 Photograph of PD006 taken on August 11, 2013 of the debris accumulation at the bridge. TIAER personnel in photograph.

Primary substrate was fine sediment that turned to mud/clay when wet (Table 4.5). During the second survey when water was present, the water surface was clear with a brown color (Tables 4.9 and 4.10). The banks were gently sloping with some livestock trails leading out and the dominant vegetation type in the corridor was salt cedar shrub land (Figure 4.21).



Figure 4.21 Photograph of PD006 taken on June 9, 2013. Upstream view of the 300-m transect. Note gentle sloping banks, lack of water and shrub dominated corridor.

Evidence of wildlife presence included frogs, and tracks of deer, turkey, raccoon, and evidence of beaver activity in the form of a gnawed tree stump. Cow manure and tracks were also seen in the creek. Garbage was rare at this site but did include the carcass of a dog at the bridge along with some sheet metal, glass bottles and aluminum cans and discarded outdoor furniture at the bridge. (Tables 4.9 and 4.10). A crushed minnow trap was also observed in the creek (Figure 4.22). No other evidence of human recreation was observed.



Figure 4.22 Photograph of PD006 taken on June 9, 2013 of a crushed minnow trap.

Physical Description of PD007

This site was surveyed on June 10 and August 12, 2013. Access to this site was on a privatized county road. The bridge of County Road 99 had washed out and was closed off to public traffic. Landowner permission was required to enter through a closed gate and drive to the site. Entry to the site was moderately difficult because dense brush on the banks and deep mud throughout the stretch made walking and wading challenging (Table 4.6). Average thalweg depths of the reach were 0.28 m during the first survey and 0.37 m during the second survey (Table 4.6).

This site was wadeable and had water present during both surveys but was never observed flowing. While multiple pockets of water were encountered, only three pools met the requirements necessary to be considered substantial pools. Two pools were observed during the first survey. One measured 126-m long, 10-m wide and 0.8-m deep. The other measured 37-m long, 15-m wide and 0.8-m deep. The pool observed during the second survey measured 32-m long, 12-m wide and 0.51-m deep. The average width overall was 8 m during the first survey and 10 m at the second (Table 4.7 and 4.8).

The dominant substrate was fine sediment that created a deep mud when submerged. This contributed to the difficulty traversing the site. The water surface was clear and brown in color during both surveys (Tables 4.9 and 4.10). Sedges along the banks and in the shallower areas were common. The banks were steep with brush lining the channel. Cultivated pasture dominated the landscape beyond the brush line at the banks.

Wildlife tracks observed included deer, cat, raccoon, great blue heron, coyote, armadillo and hog. Killdeer, minnows, and crayfish were seen as were live and dead turtles. Upon leaving the site a badger was observed running through an adjacent pasture. Fecal material noted included bird and cattle.

Garbage was rare at this site. Concrete debris, rebar and some irrigation pipe was seen at the washed out bridge transect (Figure 4.23). Along the stretch a few glass bottles were noted. Approximately half way through the 300-m stretch, debris of bricks fused with concrete and rebar were observed on the bank and down the bank into the channel (Figure 4.24). At the 300-m transect, plastic duck decoys were observed floating in the water (Figure 4.25). No other evidence of human recreation was observed.



Figure 4.23 Photograph of PD007 taken on Jun10, 2013. Downstream view at the 30-m transect. Note the concrete debris and irrigation pipe.



Figure 4.24 Photograph of PD007 taken June 10, 2013 of brick and concrete on the bank and in the stream.



Figure 4.25 Photograph of PD007 taken June 10, 2013. Downstream view at the 300-m transect. Note the pool, duck decoys and steep, shrubby banks.

Physical Description of PD008

This site was surveyed on June 14 and August 12, 2013. Initial access to this site required landowner permission to enter the property through a private entrance and drive through the property to the site (Table 4.6). Average thalweg depths of the reach were 0.00 m during the first survey and 0.00 m during the second survey (Table 4.6). Once at the site, access to the stream was easy as it primarily ran through open pasture and the banks were low (Figure 4.26). Upon crossing the fence into the neighboring property, where the channel was more densely vegetated with salt cedar, travel through the corridor was more challenging (Figure 4.27). But upon crossing the second fence back into the first property, the channel opened back up into a pasture community making travel through the creek easier.



Figure 4.26 Photograph of PD008 taken August 12, 2013. Upstream view at the 30-m transect. Note the open pastureland beyond riparian area and relative ease of access.

This segment of Paradise Creek was dry during both surveys (Table 4.7 and 4.8). No water was observed in the stream nor measured. However, a man dug pit containing muddy water was observed a few meters from the stream channel but no measurements were taken. The primary substrate of the channel was sand with bottom deposit of fine sediment (Table 4.5).



Figure 4.27 Photograph of PD008 taken June 14, 2013. Upstream view of the 150-m transect. Note the dense vegetation.

Vegetation for approximately the first and last thirds of the stretch was primarily pasture with a few trees along the bank (Figure 4.28). The middle third of the stretch was dominated by more dense salt cedar vegetation. A rudimentary man-made dam was observed at the 30-m transect.

Wildlife encountered included a cottontail rabbit, frogs, turtles, and a dead crawdad. Deer tracks were noted as were cattle tracks and ducks were audible but not seen. Horses were observed across the fence downstream out of the 300-m survey range. Garbage was rare but concentrated more in the dense brushy segment of the creek. Wooden pallets (Figure 4.29), aluminum cans, bottles, a gas can, a discarded purse, and some plastic pallets were among the garbage seen. An accumulation of debris including a tire was seen caught in the fence approximately 270 m down the transect (Tables 4.9 and 4.10). In the pastured portion of the stretch a PVC pipe under concrete comprised a pasture road crossing across the creek. No evidence of human recreation was observed at this site.



Figure 4.28 Photograph of PD008 taken on June 14, 2013 of a horse observed downstream from site.



Figure 4.29 Photograph of PD008 taken on August 12, 2013 of garbage accumulation between the 150-m and 270-m transects. Note pallets and household garbage.

Physical Description of PD009

This site was surveyed on June 9 and August 11, 2013. This site was accessible from the bridge and the highway right-of-way. However a private property sign was posted and landowner permission was attained prior to entering the property on the creek (Figure 4.30). Travel to and through this site was moderately easy although dense vegetation did make walking a challenge (Table 4.6 and Figure 4.31).



Figure 4.30 Photograph of PD009 taken on June 6, 2013 of private property sign posted on property line at county road 433 and the creek.

This segment of the Paradise Creek was dry during both surveys with an average thalweg of 0.00 m during the first and second surveys (Table 4.6, 4.7 and 4.8). No water was observed in the stream nor measured.

The dominant substrate was clay with fine sediment in the stream bottom. The corridor was dominated by shrubs on both sides and vegetation was thick through the streambed. Evidence of wildlife observed included three hogs and rooted up ground. Deer tracks were also seen in addition to a cotton tail, numerous butterflies, crawfish burrows and gnaw marks of beaver. Garbage was common in the stream (Figure 4.32) and included paper, tires, lumber, glass bottles, aluminum cans, discarded radio, and a plastic pool (Tables 4.9 and 4.10). No evidence of human recreation was observed at this site.



Figure 4.31 Photograph of PD009 taken on June 6, 2013. Downstream view at the 30-m transect. Note thick vegetation and brush on the banks. TIAER personnel in photograph.



Figure 4.32 Downstream view of the 300-m transect at Site PD009 taken August 11, 2013. Note lack of water and scattered garbage in the channel. TIAER personnel in photograph.

Physical Description of PD010

This site was surveyed on June 10 and August 12, 2013. Access to this site was on private property. Access into the channel during both surveys was moderately easy although excessive herbaceous vegetation was noted during the second survey (Table 4.6). A log obstruction and cross fence was observed in the channel that hindered travel in the creek (Figure 4.33), as well as a private property sign similar to the one shown in Figure 4.30.



Figure 4.33 Photograph of PD010 taken June 9, 2013. Downstream view at the 300-m transect. Note log obstruction. TIAER personnel in photograph.

This segment of Paradise Creek was dry with an average thalweg of 0.00 m during the first and second surveys (Tables 4.6, 4.7 and 4.8). No water was observed in the stream nor measured.

Primary substrate in the stream was clay and fine sediment comprised bottom deposit. The banks immediately adjacent to the stream were shrub dominated then opening up to improved pastureland beyond the riparian area (Table 4.5). Tracks observed of wildlife included raccoon, bird, and hog. Wildlife seen included a rabbit and frogs. Other evidence of wildlife were a snakeskin and areas rooted by hogs. Near the stream, personnel observed skeletal remains of multiple horses and cow tracks.

Garbage, in general, was rare and included glass bottles, aluminum cans, and tires (Tables 4.9 and 4.10). However some large garbage was observed during the first survey between the 0-m and 60-m transects that included tires, garden hose, large metal and wood, and pieces of concrete (Figure 4.34). Human activity in the stream was evidenced by brush cleared by heavy machinery. No evidence of human recreation was observed at this site.



Figure 4.34 Photograph of PD010 taken June 9, 2013 of large debris in creek between the 0-m and 60m transects. Note shrubs on the banks and pasture beyond.

Physical Description of PD011

This site was surveyed June 9 and August 12, 2013. Access to this site was easy as it was publically accessible from the bridge. Permission from the landowner was attained prior to entering the property the creek passed through. Once at this site, access into the stream was easy from the road side (Table 4.6). Traversing the stream however was only moderately easy because dense vegetation made walking difficult (Figure 4.35).

This segment of the Paradise Creek was dry with an average thalweg of 0.00 m during both surveys (Tables 4.6, 4.7 and 4.8). No water was observed in the stream nor measured. A man-made stone dam was observed at approximately at the 45-m transect (Figure 4.35).

The primary substrate at this site was clay and fine sediment bottom. The banks were shrub dominated with scattered trees opening up to pasture beyond the riparian area. Again the corridor was densely vegetated with occasional log jams(Table 4.5). Evidence of wildlife presence included deer tracks, armadillo tracks, a dead cotton rat, rabbit, crawfish burrows and skeleton (Figure 4.36).



Figure 4.35 Photograph of PD011 taken June 9, 2013. Upstream view of the 30-m transect. Note the dense vegetation and the stone dam.



Figure 4.36 Photograph of PD011 taken August 12, 2013 of a crawfish burrow.

Hog presence and use of the creek at this site was noticeable as tracks and rooted areas were abundant. Wildlife/livestock trails were observed transecting the creek. When leaving the site, personnel walked the outer edge of the riparian area and found multiple hog carcasses of varying size and state of decay within sight of the county road. Garbage was rare at this site but included glass bottles, aluminum cans, a tire, metal pipe and plastics (Tables 4.9 and 4.10). No evidence of human recreation was observed at this site.

Physical Description of PD012

This site was surveyed on June 10 and August 12, 2013. Access to this site was private and involved traveling down a private dirt road to the site. Once at the site accessing the stream was easy with low sloping banks and moderate vegetation (Table 4.6). Average thalweg depths of the reach were 0.00 m during the first survey and 0.00 m during the second survey (Table 4.6). An open, minimally vegetated streambed and lack of water made traversing the entire stretch easy (Figure 4.37).



Figure 4.37 Photograph of PD012 taken June 10, 2013. Downstream view of the 150-m transect. Note the lack of water, shrub dominated banks and animal tracks in the creek bed.

This segment of Paradise Creek was dry during both surveys (Tables 4.7 and 4.8). No water was observed in the stream nor measured.

The primary substrate of this site was clay which maintained visible animal tracks well. The banks were dominated by brush with some grasses at the edge of the channel (Table 4.5). Tracks of raccoon, hog and cattle were observed as were the fecal droppings of cattle and birds. A fawn and

a cottontail rabbit were also seen. No garbage or evidence of human recreation was observed at this site (Tables 4.9 and 4.10).

Physical Description of PD013

This site was surveyed on June 10 and August 12, 2013. Access to this site was public but only from the county road bridge. Fences up to the bridge restricted access and landowner permission was required to conduct the survey. Once at the site accessing the stream was easy with low sloping banks and moderate vegetation (Table 4.6). An open, minimally vegetated streambed and lack of water made traversing the entire stretch easy (Figure 4.38).



Figure 4.38 Photograph of PD013 taken June 10, 2013. Upstream view at the 150-m transect. Note the minimal brush, livestock tracks and lack of water.

This segment of Paradise Creek was dry with an average thalweg of 0.00 m during both surveys (Tables 4.6, 4.7 and 4.8). No water was measured in the stream. Although some water was observed under the bridge crossing, it was not within the 300-m survey therefore no measurements were taken.

The primary substrate of this site was clay which maintained visible animal tracks well. The banks were dominated by brush with some grasses at the edge of the channel (Table 4.5). The terrain opened up to pasture beyond the brushy corridor (Figure 4.39). Tracks of raccoon and cattle were observed as were the fecal droppings of cattle and birds. A cottontail rabbit was also seen. Garbage was common at this site and consisted of tires, glass bottles, metal bucket and a plastic can (Figure 4.39). Larger garbage included discarded TV, chair, BBQ pit, and icebox. No evidence of human recreation was observed at this site (Tables 4.9 and 4.10).



Figure 4.39 Photograph of PD013 taken June 10, 2013 of garbage in the stream bed. Note the open pastureland beyond the riparian area. TIAER personnel in photograph.

Physical Description of PD014

This site was surveyed June 10 and August 12, 2013. Access to this site was through private property including a locked gate and required landowner permission to enter. Once at the site, accessing the stream was easy with low sloping banks and moderate vegetation. An open, minimally vegetated streambed and lack of water made traversing the entire stretch easy (Table 4.6).

This segment of Paradise Creek was dry during the first survey (Tables 4.7 and 4.8). Some measureable pockets of water existed during the second survey. The average thalweg depth during the second survey was 0.03 m (Table 4.6) and the maximum width was 2.8 m (Table 4.8).

The primary substrate of this site was clay which maintained visible animal tracks well and, where water was present, fine sediment characterized the creek bottom. Also, where water was present, algae cover was common, aquatic vegetation abundant, and the color of the water was brown (Table 4.10). Approximately 50% of the banks were dominated by brush with some grasses at the edge of the channel (Table 4.5). The other 50% of the banks were improved pasture. At approximately 120m, a tile drain was observed in the bank (Figure 4.40) and a transmission line right of way and road were encountered at the 150-m transect (Figure 4.41).

Tracks of raccoon, canine, deer, horse, and cattle were observed as were cow and bird feces. A crawdad burrow and shed shell were seen as were quail and dove. Garbage was rare at this site

and consisted of tires, glass bottles, metal bucket and a plastic jug (Tables 4.9 and 4.10). No evidence of human recreation was observed at this site.



Figure 4.40 Photograph of PD014 taken August 12, 2013. Upstream view of the 150-m transect. Note open corridor with minimal brush and transmission line right of way bisecting the creek



Figure 4.41 Photograph of PD014 taken June 10, 2013 of a tile drain at the 120-m transect.

Physical Description of PD015

This site was surveyed June 14 and August 12, 2013. Public access to this site was available from the bridge only. Landowner permission was attained prior to traveling down the stream from the bridge. Entering the stream was moderately difficult due to dense vegetation and steep banks (Table 4.6). Average thalweg depths of the reach were 0.00 m during the first survey and 0.00 m during the second survey (Table 4.6). Traversing the stream was hindered by continued dense vegetation throughout the length of the survey. Numerous steel pipes bisecting the creek presented an obstacle to duck under and climb over (Figure 4.42).



Figure 4.42 Photograph of PD015 taken June 14, 2013 of multiple steel pipes bisecting the creek. Note lack of water, dense bank vegetation and sandy substrate.

This segment of Paradise Creek was dry during both surveys (Tables 4.7 and 4.8). No water was observed in the stream nor measured. The primary substrate at this site was sand. The riparian zone was dominated on both sides by dense shrub vegetation, primarily salt cedar (Table 4.5). Tumbleweeds were also abundant in the creek at the bridge and scattered downstream throughout the survey reach.

Wildlife evidence included tracks of deer, raccoon, hog and bobcat. Hog wallows were also observed (Figure 4.43). Fecal material of deer and birds were observed in the creek. Some dead crayfish were seen along with bleached cow bones. Garbage was abundant in the creek, especially during the second survey. This included tires, bricks, pipe, a bucket, cardboard, discarded tarp, glass bottles, aluminum cans, and various plastics (Tables 4.9 and 4.10). A working pump jack and petroleum storage tanks existed within approximately 50m of the stream at this site. Also, during the time the surveys were taking place, construction of new transmission lines was in progress in the immediate area. Construction traffic was noticeable on County Road 138. No evidence of human recreation was observed at this site.



Figure 4.43 Photograph of PD015 taken August 12, 2013 of hog wallow at 180-m transect with range finder placed for scale. Note garbage in the dried mud.

Physical Description of PD016

This site was surveyed on June 10 and August 11, 2013. Public access to this site was available from the bridges at the county road and the power line right of way only. Landowner permission was attained prior to traveling the streambed away from the bridges. Entering the stream was moderately difficult due to steep unstable banks (Table 4.6). Traversing the stream was hindered by dense vegetation and abundant tumbleweeds throughout the survey reach (Figure 4.44). A barbed wire fence bisecting the creek at 120 m also created an obstacle.

This segment of Paradise Creek was dry during both surveys with an average thalweg of 0.00 m (Tables 4.6, 4.7 and 4.8). No water was observed in the stream nor measured. The primary substrate at this site was sand. The riparian zone was dominated on both sides by dense shrubby vegetation, primarily salt cedar, for most of the stretch (Table 4.5 and Figure 4.45). Grasses grew in the channel and pastureland existed beyond the riparian area. Some areas near the road and right of way were devoid of shrubs and pastureland occurred up to the banks.

Wildlife evidence included tracks of deer, raccoon and hog. Fecal material of deer, birds, and some of unknown origin were observed in the creek. Most noticeable at this site were the numerous hog tracks and tumbleweeds throughout the 300-m stretch. Garbage in the channel was common, especially glass bottles and aluminum cans during the second survey. Other garbage included tires, bricks, pipe, a bucket, and various plastics (Tables 4.9 and 4.10). New transmission line construction was in progress in the immediate area and construction traffic was noticeable on

County Road 138 and the right of way. No evidence of human recreation was observed at this site.



Figure 4.44 Photograph of PD016 taken June 10, 2013 of accumulation of tumbleweeds in the channel. TIAER personnel in photograph.

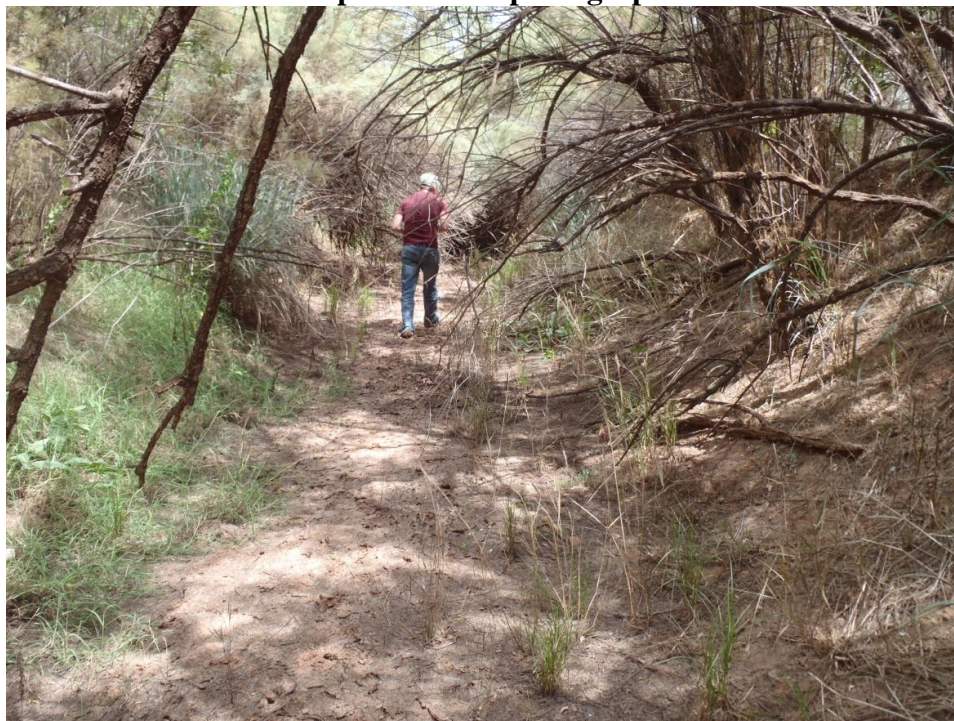


Figure 4.45 Photograph of PD016 taken August 11, 2013. Downstream view at the 150-m transect. Note densely vegetated banks, lack of water and grass in the channel. TIAER personnel in photograph.

Physical Description of PD017

This site was surveyed on June 9 and August 13, 2013. Although access to this site is considered public, private fencing was built up to the bridge on both sides (Figure 4.46). Therefore, this site has significantly limited public access availability (Table 4.6). Permission from the landowner was granted to enter the stream. Barbed wire fencing and steep banks at the bridge initially made access moderately difficult. The channel was deep, however the banks were grassy and gently sloping with frequent livestock trails leading into the creek. All other travel through the creek at this site was easy and no obstacles were encountered.



Figure 4.46 Photograph of PD017 taken August 13, 2013 of limited access at bridge. Note the private fencing connecting to bridge.

This segment of Paradise Creek was wadeable with very little water encountered the first survey and dry during the second survey (Tables 4.7 and 4.8). During the first survey there was one pocket of water observed at the county road bridge, which measured 0.21m deep and 8.0m wide (Table 4.6). Average thalweg depths of the reach were 0.01 m during the first survey and 0.00 m during the second survey (Table 4.6). No other water was observed or measured at this site.

The primary substrate was sand in some places and clay/mud under the bridge where water was standing during the first survey (Table 4.5). The corridor was dominated by improved pasture however some brush existed in the stream bed (Figure 4.47). Where water was present, the surface was free of any scum or algae and the color was slightly brown but the bottom sediment was visible.



Figure 4.47 Photograph of PD017 taken August 13, 2013. Downstream view at the 300-m transect. Note lack of water, pasture at the top of the banks with some shrubs on the bank and in the channel. TIAER personnel in photograph.

Evidence of wildlife observed included tracks of armadillo, deer, canine, raccoon, birds, and snakes. Upon entering the site during the second survey an owl was flushed out from under the bridge. Crawdad exoskeleton was seen as were the bleached bones of a cow. Tadpoles were observed in the pocket of water at the bridge as were the tracks of a bobcat (Figure 4.48). Cow manure and tracks as well as bird droppings were observed in the creek. At approximately the 30-m transect a bird nest was seen in a salt cedar growing in the middle of the channel (Figure 4.49). Garbage at this site was rare but did include an office chair at the bridge, scrap metal, glass bottles, cans, a shotgun shell, some pipe, feed sack, a piece of garden hose, a scrap of carpet, plastic bottles, bricks, and a tire on the bank. The majority of the garbage seen was in approximately the first 50 m from the bridge (Tables 4.9 and 4.10). No evidence of human recreation was observed at this sight.



Figure 4.48 Photograph of PD017 taken August 13, 2013 of bobcat tracks.



Figure 4.49 Photograph of PD017 taken June 9, 2013 of a bird nest.

Physical Description of PD018

This site was surveyed on June 9 and August 12, 2013. Although access to this site is considered public, private fencing was built up to the bridge on both sides. Therefore, this site has significantly limited public access availability (Table 4.6). Permission from the landowner was granted to enter the stream. Barbed wire fencing at the bridge initially made access moderately difficult (Figure 4.50). Further access to this site was moderately easy, however, some thick vegetation and frequent log jams were encountered (Figure 4.51).



Figure 4.50 Photograph of PD018 taken June 9, 2013. Downstream view at the 300-m transect taken from the county road crossing. Note the private property barbed wire fence limiting public access.

This segment of Paradise Creek was dry with an average thalweg of 0.00 m during both surveys (Tables 4.6, 4.7 and 4.8). No water was observed in the stream nor measured. The dominant substrate at this site was clay. The corridor was dominated by dense shrub vegetation on both banks (Table 4.5 and Figure 4.52).

Wildlife presence was evidenced by tracks of raccoon, deer and hog. Cattle were observed in the vicinity of the creek. Bird, coyote, and cow fecal material was found in the stream as well. Garbage was rare at this site but did include an old refrigerator, plastic jug, some discarded lumber, and aluminum cans (Tables 4.9 and 4.10). No evidence of human recreation was observed at this site.



Figure 4.51 Photograph of PD018 taken June 9, 2013. Obstruction at 215-m transect.



Figure 4.52 Photograph of PD018 taken August 12, 2013. Downstream view at the 300-m transect. Note lack of water, garbage in the stream and shrub dominated corridor. TIAER personnel in photograph.

Physical Description of PD019

Site not surveyed. Removed from list of RUAA field survey sites at landowner request.

Physical Description of PD020

This site was surveyed on June 10 and August 13, 2013. Access to this site was on private property and permission from the landowner was granted to access the property through a gate and cattle guard to enter the stream (Table 4.6). Travel down to the site involved driving through a pasture stocked with cattle. Barbed wire fencing and steep banks at the bridge made entering the stream moderately difficult. The channel was deep, however the banks were grassy and gently sloping with frequent livestock trails leading into the creek. All other travel through the creek at this site was easy and no obstacles were encountered.



Figure 4.53 Photograph of PD020 taken June 10, 2013. Upstream view at 300-m transect. Note limited public access point. TIAER personnel in photograph.

This segment of Paradise Creek was dry with an average thalweg of 0.00 m during both surveys (Tables 4.6, 4.7 and 4.8). No water was observed or measured at this site. The primary substrate was clay/mud under the bridge where water was standing during the first survey (Table 4.5). The corridor was dominated by improved pasture; however, some brush existed in the stream bed (Figure 4.54).



Figure 4.54 Photograph of PD020 taken August 13, 2013. Downstream view at the 300-m transect. Note lack of water, gentle slopes with improved grass and some shrubs.

Evidence of wildlife observed included tracks of deer, raccoon, and birds. Upon entering the site during the second survey an owl was flushed out from under the bridge. Crawdad exoskeleton was seen as were the bleached bones of a cow. Cow manure and tracks as well as bird droppings were observed in the creek. Garbage at this site was rare (Tables 4.9 and 4.10), but did include plastic bottle, baling twine, tire, scrap metal, piece of tar paper, and glass bottle. No evidence of human recreation was observed at this site.

Physical Description of PD021

This site was surveyed on June 10 and August 13, 2013. Access to this site was on private property and permission from the landowner was granted to access the property through an electric fence to enter the stream (Table 4.6). Travel down to the site involved driving along the neighbors' fence line along the edge of a cultivated field. The channel was deep, however the banks were grassy and gently sloping with frequent livestock trails leading into the creek (Figure 4.55). All other travel through the creek at this site was easy and no obstacles were encountered.

This segment of Paradise Creek was dry with an average thalweg of 0.00 m during both surveys (Tables 4.6, 4.7 and 4.8). No water was observed or measured at this site. The primary substrate was clay/mud (Table 4.5). The corridor was dominated by improved pasture on the right bank and cultivated field on the left bank. However, some brush existed in the stream bed.



Figure 4.55 Photograph of PD021 taken on June 10, 2013. Downstream view of the 150-m transect. Note the sloping banks, brush along stream and scattered cow bones.

Evidence of wildlife observed included tracks of deer, hog, canine, rabbit, kangaroo rat and armadillo. Bird droppings and cow manure were seen as were the bleached bones of a cow. At the 0-m transect brick and concrete debris were observed in the creek. Between the 150-m and 300-m transects a large steel pipe, approximately 3-ft diameter was observed lying in the creek parallel with the banks (Figure 4.56). Garbage at this site was rare but did include baling twine, tire, scrap metal, a spent shotgun shell, discarded outdoor tablecloth, trash bag, tarp, glass bottles and aluminum cans (Tables 4.9 and 4.10). No evidence of human recreation was observed at this site.



Figure 4.56 Photograph of PD021 taken June 10, 2013 of steel pipe in stream. Note wading rod leaning against it for scale.

Physical Description of PD022

This site was surveyed June 11 and August 12, 2013. It was accessible from the bridge of a county road, however, landowner permission to cross a private fence was required to conduct the entire survey (Table 4.6). Traversing the stream was easy, as it had no water in it, the bottom was dry and firm with gently sloping banks and only a few log obstructions (Figure 4.47).

This portion of Paradise Creek was dry with an average thalweg of 0.00 m during both surveys (Tables 4.6, 4.7 and 4.8). No water was observed in the stream or measured. The primary substrate was a mud/clay but the creek was dry therefore mud was not encountered. Shrubs dominated the edges of the creek, along with grasses. Native and improved pastures lay beyond the riparian area (Table 4.5). Banks were gently sloping.

Evidence of wildlife presence was rare, however, tracks of hog and deer were observed in addition to bird droppings (Tables 4.9 and 4.10). Field crews also reported seeing a rabbit in the stream. Tracks and manure of cattle was noted as well. Small amounts of garbage were only detected in the channel. Glass bottles and a spent shotgun shell were the only garbage observed at this site. No evidence of human recreation was observed at this site.



Figure 4.57 Photograph of PD022 taken August 12, 2013. Upstream view of the 300-m transect. Note lack of water, log obstruction, shrub and grass dominated corridor.

Physical Description of PD023

This site was surveyed June 10 and August 12, 2013. Access to this site was through a private gate only with landowner permission. Once at the site, access to the stream channel was moderately easy (Table 4.6). It lacked water, the bottom was dry and firm with gently sloping banks and a few log obstructions (Figure 4.58). Heavy vegetation added some difficulty to conducting the survey at this site.

This portion of Paradise Creek was dry with an average thalweg of 0.00 m during both surveys (Tables 4.6, 4.7 and 4.8). No water was observed in the stream or measured. The primary substrate was a mud/clay but the creek was dry therefore mud was not encountered. The corridor was approximately 50% forested and 50% shrubland (Table 4.5 and Figure 4.49). Banks were gently sloping.

Evidence of wildlife presence was rare, however, tracks of deer were observed in addition to bird droppings (Tables 4.9 and 4.10). Evidence of hog activity was observed in the form of wallows and tracks. Field crews also reported seeing a rabbit in the stream bed. Tracks and manure of cattle was noted as well. Small amounts of garbage, glass bottles, were only detected in the channel. No evidence of human recreation was observed at this site.



Figure 4.58 Photograph of PD023 taken June 10, 2013 of a log obstruction.



Figure 4.59 Photograph of PD023 taken August 12, 2013. Upstream view at the 150-m transect. Note shrub and grass vegetation on the banks and lack of water.

Physical Description of PD024

This site was surveyed June 9 and August 13, 2013. Public access to this site was available from the bridge only. Landowner permission was attained prior to travelling down the stream from the bridge (Table 4.6). It lacked water, the bottom was dry and firm with gently sloping banks and a few log obstructions. Thick vegetation in places added some difficulty to conducting the survey at this site.

This portion of Paradise Creek was dry with an average thalweg of 0.00 m during both surveys (Tables 4.6, 4.7 and 4.8). Some small pockets of water were observed during the second survey. None were more than a few inches deep, therefore no water in the stream was measured.

The primary substrate was a mud/clay. The corridor was primarily shrubland (Table 4.5 and Figure 4.60). Banks were gently sloping. Evidence of wildlife presence was rare, however hog tracks were observed (Tables 4.9 and 4.10). Tracks and manure of cattle were noted as well. The only garbage observed was during the first survey of a small compressed-helium tank. No evidence of human recreation was observed at this site (Figure 4.61).



Figure 4.60 Photograph of PD 024 taken August 13, 2013. Upstream view of the 150-m transect. Note lack of water and dense bank vegetation. TIAER personnel in photograph.



Figure 4.61 Photograph of PD024 taken June 9, 2013 of a compressed-helium tank.

Physical Description of PD025

This site was surveyed June 10 and August 12, 2013. Access to the stream at this site is only possible from the bridge crossing. Private fencing was built up to the sides of the bridge (Figure 4.62), and landowner permission was required to access the site through a closed gate in order to conduct the survey (Table 4.6). Once at the site, travel through the stream was easy, except for a few pockets of water where wading through the mud was difficult.

The stream at this site was wadeable. The creek was not flowing during either survey, though pockets of water were observed during both surveys (Tables 4.7 and 4.8). Average thalweg depths were 0.01 m and 0.03 m, respectively (Table 4.6). The maximum stream width recorded was 3 m recorded during the second survey (Table 4.8).

Primary substrate consisted of a clay/mud mix. The corridor at this site was dominated by shrubs on both banks. Current construction of a power line right of way bisected the creek between the 150-m and 300-m transects, which formed a break in the bank vegetation (Table 4.5). This section of the creek had been excavated to develop a low crossing across the creek for vehicles. Additionally, erosion control structures and related materials were present in the channel and along the banks within the vicinity of the construction activity (Figure 4.63). During the first survey water surfaces had foam and scum and the color of the water was green. During the second survey water surfaces had only scum and the color had become brown (Figure 4.64).



Figure 4.62 Photograph of PD025 taken June 10, 2013. Left bank view at the 300-m transect. Note fence line built up to edge of bridge limiting public access and presence of water.



Figure 4.63 Photograph of PD025 taken June 10, 2013 of power line construction right of way crossing the stream between 300-m and 150-m transects. Note excavated earth, pocket of water and erosion control structures.



Figure 4.64 Photograph of PD025 taken June 10, 2013. Downstream view at the 150-m transect. Note foam/scum on water and shrub dominated banks.

Evidence of wildlife was rare but included tracks and feces of deer, hog, bird and coyote. Additionally, a wasp nest was observed, a covey of quail was flushed and dead crawdads were found in the creek. Garbage also was rare at this site but did include a tire, glass bottles, and aluminum cans. Some discarded fencing was also found in the channel (Table 4.9 and 4.10). No evidence of human recreation was observed at this site.

Physical Description of PD026

This site was surveyed June 9 and August 12, 2013. This site is publically accessible at the bridge on CR 288 and at a transmission line road. Nevertheless, landowner permission was obtained prior to conducting the surveys. Accessing this site for the survey was moderately difficult primarily because of dense vegetation (Table 4.6 and Figure 4.65).

Water was encountered only during the second survey and the average thalweg depth measured 0.02 m with a maximum stream width of 3 m (Table 4.6 and 4.8).

The primary substrate of this site was clay/mud but limited presence of water rendered the majority of the stretch dry therefore not muddy. Banks were dominated by shrubs on both sides, primarily salt cedar (Table 4.5). Where water was observed, the surface had a scum layer and was brown in color (Tables 4.9 and 4.10).



Figure 4.65 Photograph of PD026 taken August 12, 2013. Downstream view at the 300-m transect. Note the dense vegetation.

Similarly to PD025, new transmission line construction and a right of way bisected the creek between the 30m and 150m transects. However a more substantial crossing had been built including a culvert and rip-rap (Figure 4.66). A flatbed trailer loaded with transmission line components was observed near the riparian area (Figure 4.67).

Wildlife presence was not detected however tracks of raccoon, deer and a canine were observed. Feces and tracks of hogs were seen as well. Garbage in the stream and banks was rare but included a tire, plastic jugs, paper towels, aluminum cans, weed cutter handle, and a rusted barrel. No evidence of human recreation was observed at this site.



Figure 4.66 Photograph of PD026 taken August 12, 2013 of the transmission line right of way located between the 30-m and 150-m transects.



Figure 4.67 Photograph of PD026 taken June 9, 2013. Left bank view at the 30-m transect. Note the flatbed trailer loaded with transmission line components.

Physical Description of PD027

This site was surveyed June 9 and August 11, 2013. It was accessible from the county road bridge, however, landowner permission to cross a private fence was required to conduct the entire survey (Figure 4.68). Traversing the stream was easy as it had no water in it, the bottom was dry and firm with gently sloping banks and only a few log obstructions (Table 4.6).



Figure 4.68 Photograph of PD027 taken August 11, 2013. Upstream view at the 300-m transect. Note limited public access at the county road, private fence and garbage.

This segment of Paradise Creek was wadeable and dry during both surveys with an average thalweg of 0.00 m (Tables 4.6, 4.7 and 4.8). No water was observed in the stream or measured. The primary substrate was clay but the creek was dry therefore mud was not encountered. Shrubs dominated the edges of the creek along with grasses on both banks. Native pastures lay beyond the riparian area (Table 4.5). Banks were gently sloping.

Evidence of wildlife presence was rare, however, tracks of hog, raccoon, and deer were observed in addition to bird droppings (Tables 4.9 and 4.10). Field crews reported seeing a rabbit in the stream bed as well as a deer carcass. Tracks and manure of cattle were seen in the creek and four bulls were encountered in the pasture. Small amounts of garbage were only detected in the channel. Glass bottles, aluminum cans, tires, concrete block, discarded lumber, and livestock mineral tubs were the only garbage observed at this site (Figure 4.69). No evidence of human recreation was observed at this site.



Figure 4.69 Photograph of PD027 taken June 9, 2013. Note log obstruction, livestock mineral bucket and concrete block.

Physical Description of PD028

This site was surveyed June 11 and August 13, 2013. Access to this site was through a private gate only with landowner permission. Once at the site, access to the stream channel was moderately easy (Table 4.6). It lacked water, the bottom was dry and firm with gently sloping banks and a few log obstructions. Heavy vegetation added some difficulty to conducting the survey at this site (Figure 4.70).

This segment of Paradise Creek was dry with an average thalweg of 0.00 m during both surveys (Tables 4.6, 4.7 and 4.8). No water was observed in the stream or measured.

The primary substrate was a mud/clay but the creek was dry therefore mud was not encountered. The area immediately at the edge of the creek has some shrubby vegetation but is primarily native pasture up to the edge of the creek (Table 4.5 and Figure 4.71).

Wildlife evidence observed included a cottontail rabbit, rattlesnake and deer tracks. Cattle manure and tracks were seen as well. Garbage in the channel was rare but included aluminum cans, a feed sack, and a styrofoam cup (Tables 4.9 and 4.10). No evidence of human recreation was observed at this site.



Figure 4.70 Photograph of PD028 taken June 11, 2013. Log obstruction and dense vegetation at 200-m transect.



Figure 4.71 Photograph of PD028 on June 11, 2013. Upstream view of the 300-m transect. Note private fence bisecting the creek and pasture dominated corridor.

Observation and Interviews

Activities Observed for Paradise Creek (0230A)

During each RUAA survey, field personnel visited the sites during times of days and on days when recreational activities were apt to be observed. Nine of the 27 sites were located on private property and TIAER personnel were granted permission from the landowners to conduct the RUAA at these locations. The other 18 sites were at locations that provided public access, although some only at the bridge that crosses the stream. An additional site, PD19 located on Ranch Road 1207, was withdrawn from the RUAA list by the landowner after sites had been approved for the project. This site was not used as an RUAA site; however the landowner had indicated support of the RUAA project.

No contact (primary or secondary) or noncontact recreational activities were observed by TIAER employees at any of the sites during the field surveys. Some evidence of possible recreation occurring were found. One spent shotgun shell was observed at site PD021 and one at site PD022. An operable minnow trap was found at site PD006. And at site PD007, duck decoys were found floating in one of the pools. No other evidence of recreation was found at any of the other sites.

Activities Interviewed for Paradise Creek (0230A)

Interviews were conducted for landowners along Paradise Creek and other persons of interest. A total of 16 interviews were collected. Primary contact recreation was reported to have occurred in the lower five miles of Paradise creek only. According to one interview conducted regarding site PD002, swimming and children wading had occurred although infrequently since water levels were rarely adequate for such activities. An interview regarding sites PD004 and PD005 reported having swum, observed swimming and heard of swimming near these sites on a regular basis during the summers as a child. Another survey regarding these same sites reported water was present at these locations from 1974 until about 2007 at which time the creek dried up. Prior to 2007, this interviewee reported having seen children catching crawfish in the stream as well as people fishing for sunfish, more so at site PD005. After 2007 however, no further recreation was reported by this interviewee. Another instance of observing and hearing of fishing was reported at site PD001 and an interviewee representing site PD019 reported having fished only 2 or 3 times in the past 50 years. Hunting was reported to have been participated in specifically at sites PD012 and PD013. Interviewees, not reporting on a specific site, reported observing, hearing about and participating in hunting in the vicinity of Paradise creek in general. Table 4.11 summarizes the types of recreational activities indicated by the interviews.

Table 4.11 Summary of Interviews conducted on Paradise Creek.

Activities are listed as the number of times personal use, observed use, or heard of use was documented from interviews for a given location or the whole assessment unit. Blank cells indicate no interviewed feedback for that location. An * indicates recreation at multiple sites from one interview form. No recreational activities were observed during field surveys or site visits.

Site Name	Swimming	Adult Wading	Children Wading	Hunting	Fishing	Boating/Canoeing
PD001	0,0,0	0,0,0	0,0,0	1,1,1	0,1,1	0,0,0
PD002	1,0,0	0,0,0	1,0,0	*	2,0,1*	0,0,0
PD003						
PD004	1,1,1	0,0,0	1,0,0	0,0,0	0,1,0	0,0,0
PD005	*	0,0,0	*	*	*	0,0,0
PD006	0,0,0	0,0,0	0,0,0	0,0,0	0,0,0	0,0,0
PD007						
PD008						
PD009						
PD010	0,0,0	0,0,0	0,0,0	0,0,0	0,0,0	0,0,0
PD011	0,0,0	0,0,0	0,0,0	0,0,0	0,0,0	0,0,0
PD012	0,0,0	0,0,0	0,0,0	1,0,0	0,0,0	0,0,0
PD013	0,0,0	0,0,0	0,0,0	*	0,0,0	0,0,0
PD014						
PD015				*		
PD016				*		
PD017	0,0,0	0,0,0	0,0,0	*	0,0,0	0,0,0
PD018				*		
PD019	0,0,0	0,0,0	0,0,0	*	0,1,0	0,0,0
PD020	0,0,0	0,0,0	0,0,0	0,0,0	*	0,0,0
PD021					*	
PD022					*	
PD023					*	
PD024					*	
PD025					*	
PD026					*	
PD027	0,0,0	0,0,0	0,0,0	0,0,0	0,0,0	0,0,0
PD028	0,0,0	0,0,0	0,0,0	0,0,0	0,0,0	0,0,0
General	0,0,0	0,0,0	0,0,0	0,0,0	0,0,0	0,0,0
Totals	2,1,1	0,0,0	2,0,0	2,1,1	2,3,2	0,0,0

Summary

RUAA surveys were conducted at 27 sites along Paradise Creek (unclassified water body 0230A) on June 9-11, 2013, June 14, 2013, and August 11 – 13, 2013.

The majority of this creek was dry or not flowing during both surveys. Where water was present it was shallow with aquatic vegetation, algae, occasional foul odor or scum and muddy bottoms. Site PD007 had the largest occurrence of water with a greatest width of 18 m and 0.37 m at its deepest, however, steep banks and the sludge-like bottom of the stream would make any form of recreation difficult.

During the two surveys, there were no recreational activities observed by TIAER field staff. Additionally, there were no non-contact recreational activities observed during either survey. Recreational activities reported by interviewees are summarized in Table 4.11, Figure 4.72 and the overall RUAA findings are summarized in the form below.

The Palmer Drought Severity Index (PDSI) represented extreme drought conditions during the first survey in June 2013 and moderate drought conditions during the second survey in August 2013.

While conducting the stream surveys, no characteristics, such as boat docks, parks, playgrounds, biking trails, campgrounds or sports fields, were encountered that would promote recreation.

The rural nature of the area surrounding Paradise Creek is an impediment to recreation. Eighteen of the twenty-seven sites are located at public road crossings, however access to the stream at these crossings are significantly impeded by private fences at or near the bridges. All other sites surveyed on Paradise Creek are only accessible through private property that is fenced, gated and/or locked. Access to most of the stream can only be gained through these properties by permission of the landowner. Even then, according to the interviewees, and especially since 2007, there has typically been insufficient water to afford primary contact recreation. In the majority of the reach, there is no water to allow any form of water recreation.

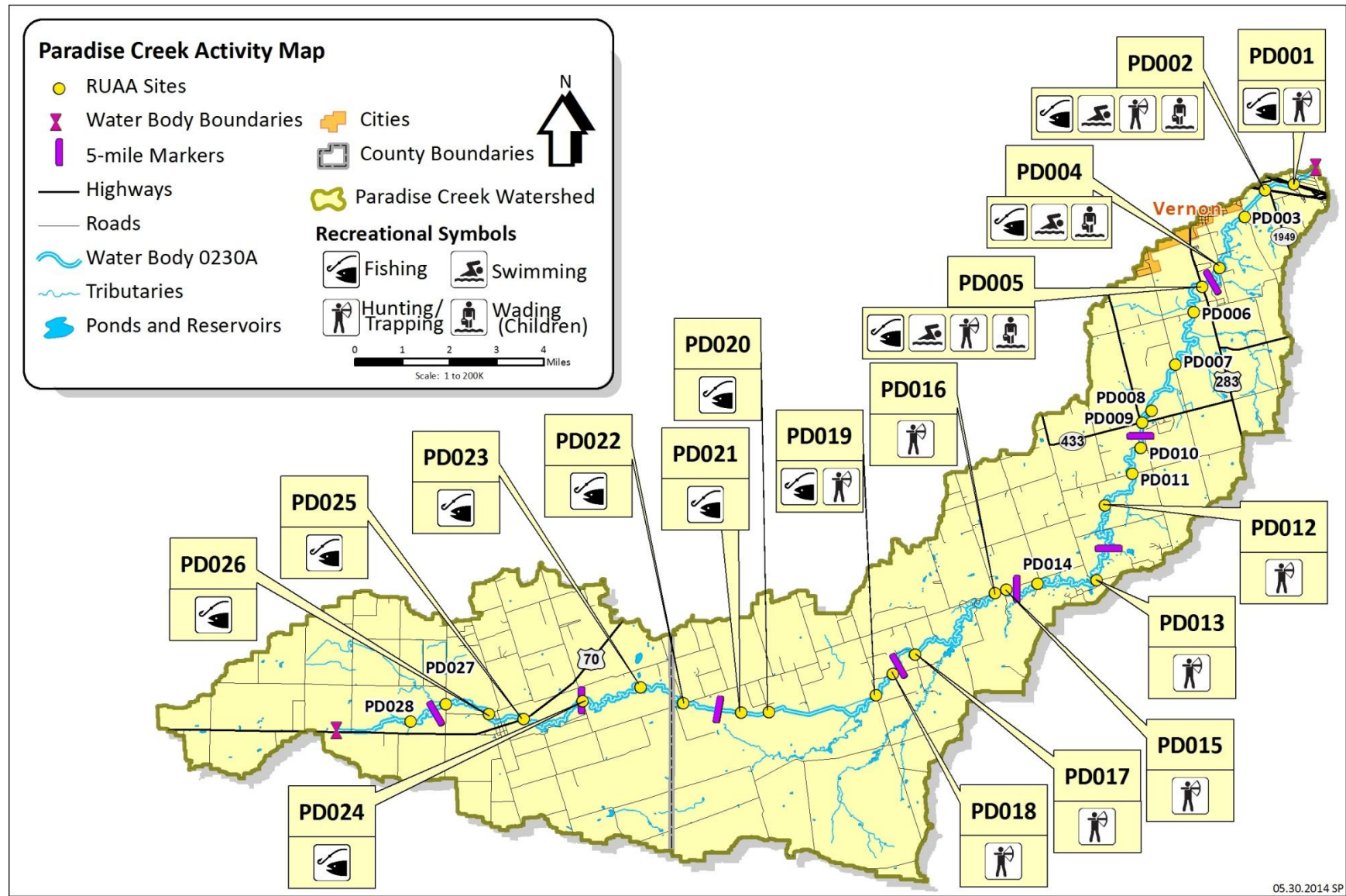


Figure 4.72 Summary of observed and interviewed human activities on Paradise Creek.

RUAA Summary

Name of water body: Paradise Creek

Segment No. of Nearest Downstream Segment No.:0230

Classified?: No

County: Wilbarger & Foard

1. Observations on Use

a. Do primary contact recreation activities occur on the water body?

☐ frequently ☒ seldom ☐ not observed or reported ☐ unknown

b. Do secondary contact recreation 1 activities occur on the water body?

☐ frequently ☒ seldom ☐ not observed or reported ☐ unknown

c. Do secondary contact recreation 2 activities occur on the water body?

☐ frequently ☒ seldom ☐ not observed or reported ☐ unknown

d. Do noncontact recreation activities occur on the water body?

☐ frequently ☒ seldom ☐ not observed or reported ☐ unknown

2. Physical Characteristics of Water Body

a. What is the average thalweg depth? 0.03 meters

b. Are there substantial pools deeper than 1 meter? ☐ Yes ☒ No

c. What is the general level of public access?

☐ easy ☐ moderate ☒ very limited

3. Hydrological Conditions of site visits (Based on Palmer Drought Severity Index)

☒ Mild-Extreme Drought

☐ Incipient dry spell

☐ Near Normal

☐ Incipient wet spell

☐ Mild-Extreme Wet

Chapter 5

Sweetwater Creek

(0299A)

Watershed Characteristics

The Sweetwater Creek watershed covers 242,665 acres and includes the cities of Wheeler (estimated population 1,609) and Mobeetie (estimated population 102) (Figure 5.1). Local springs include Fort Elliott Springs two miles west of Mobeetie and Rathjen Springs 11 miles northeast of Wheeler. These springs feed into Sweetwater Creek; however, since the 1960s, spring flows have reduced substantially (Brune, 1975). The watershed overlays a small portion of the Ogallala Aquifer (George et al., 2011). The terrain varies from flat to rolling hills, and dominant soil types consist of sand and sandy loams (TSHA, 2013).

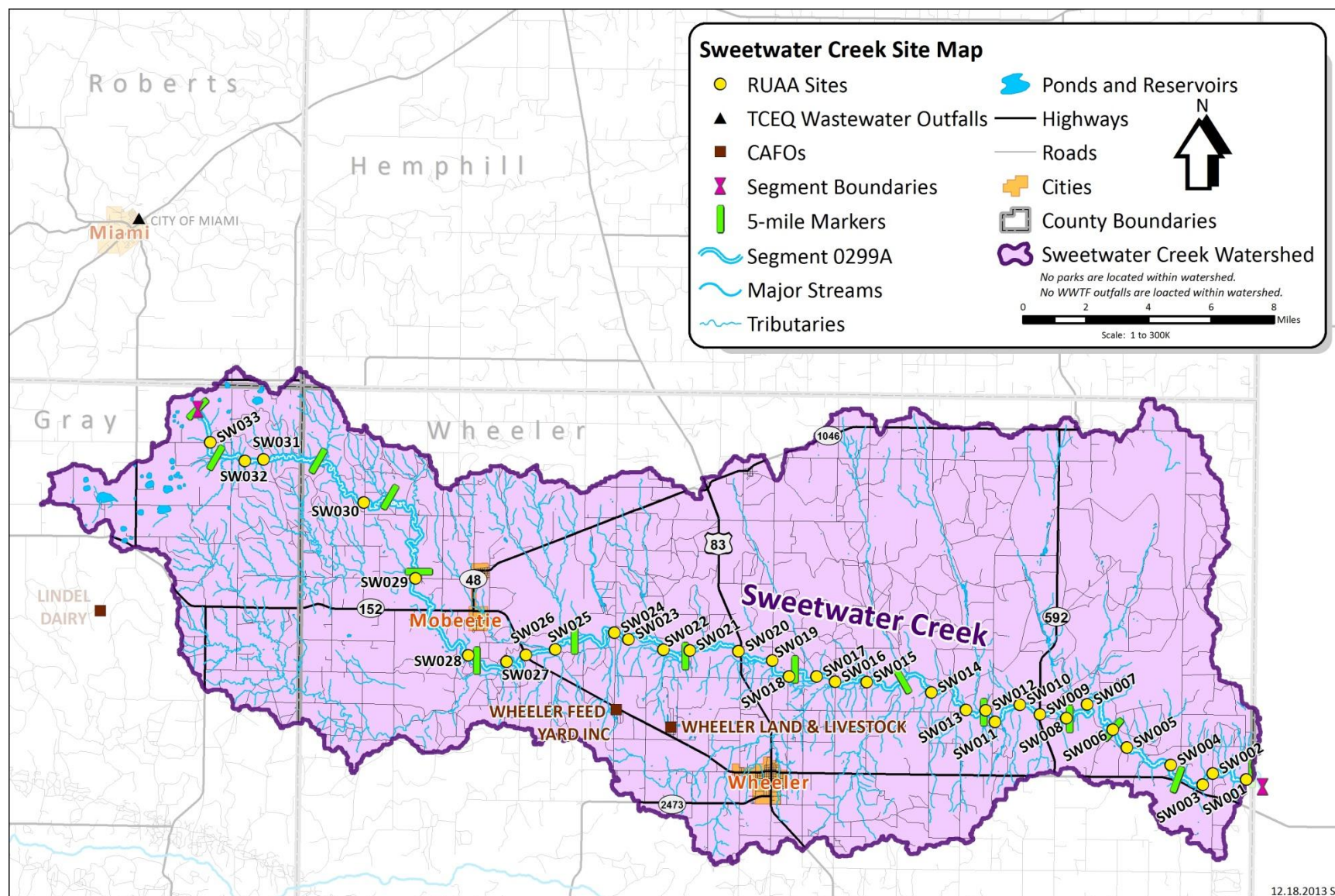
The Sweetwater Creek upper watershed lies partly within the Canadian/Cimarron Breaks ecoregion (26a) while the lower watershed lies within the Red Prairie ecoregion (27h) (Griffith et al., 2007). Average rainfall ranges from 19 to 23 inches annually in the Canadian/Cimarron Breaks ecoregion and 20 to 28 inches annually in the Red Prairie ecoregion. Mean minimum and maximum temperatures for the region range from 22 to 48°F in January and 66 to 93°F for July. The dominant land use categories within the Sweetwater Creek watershed reflect a generally rural landscape (Figure 5.2). Grassland/herbaceous accounts for almost 60 percent of the watershed area with shrub/scrub comprising just over 30 percent. The urban landscape (developed use) accounts for less than three percent of the total land area. The riparian area along the stream often does contain woody vegetation. Woody vegetation within the Canadian/Cimarron Breaks ecoregion is dominantly comprised of black willow (*Salix nigra*), hackberry (*Celtis occidentalis*), skunkbush sumac (*Rhus trilobata*), Chickasaw plum (*Prunus angustifolia*), the invasive alien salt cedar (*Tamarix* spp.), cottonwoods (*Populus deltoides*), and elms (*Ulmus crassifolia*) (Griffith, 2007).

Designated Uses, Impairments, and Concerns

Sweetwater Creek (0299A) is classified as a perennial stream (TCEQ, 2013) and has designated uses of primary contact recreation, general use, and fish consumption with high aquatic life use. Sweetwater Creek was first listed impaired for bacteria on the 2002 Texas 303(d) list and has no other parameters listed for impairments or concerns.

Permitted Discharges

The City of Wheeler WWTF (WQ0010382001, RN102844420) is located on the east side of US Highway 83, approximately 1 mile north of State Highway 152. The facility is a Texas Land Application Permit (TLAP). Thus, treated effluent is not discharged directly into a tributary of Sweetwater Creek, but is used for irrigation water.



12.18.2013 SP

Figure 5.1 Overview of Sweetwater Creek watershed and RUAA sites for water body 0299A.

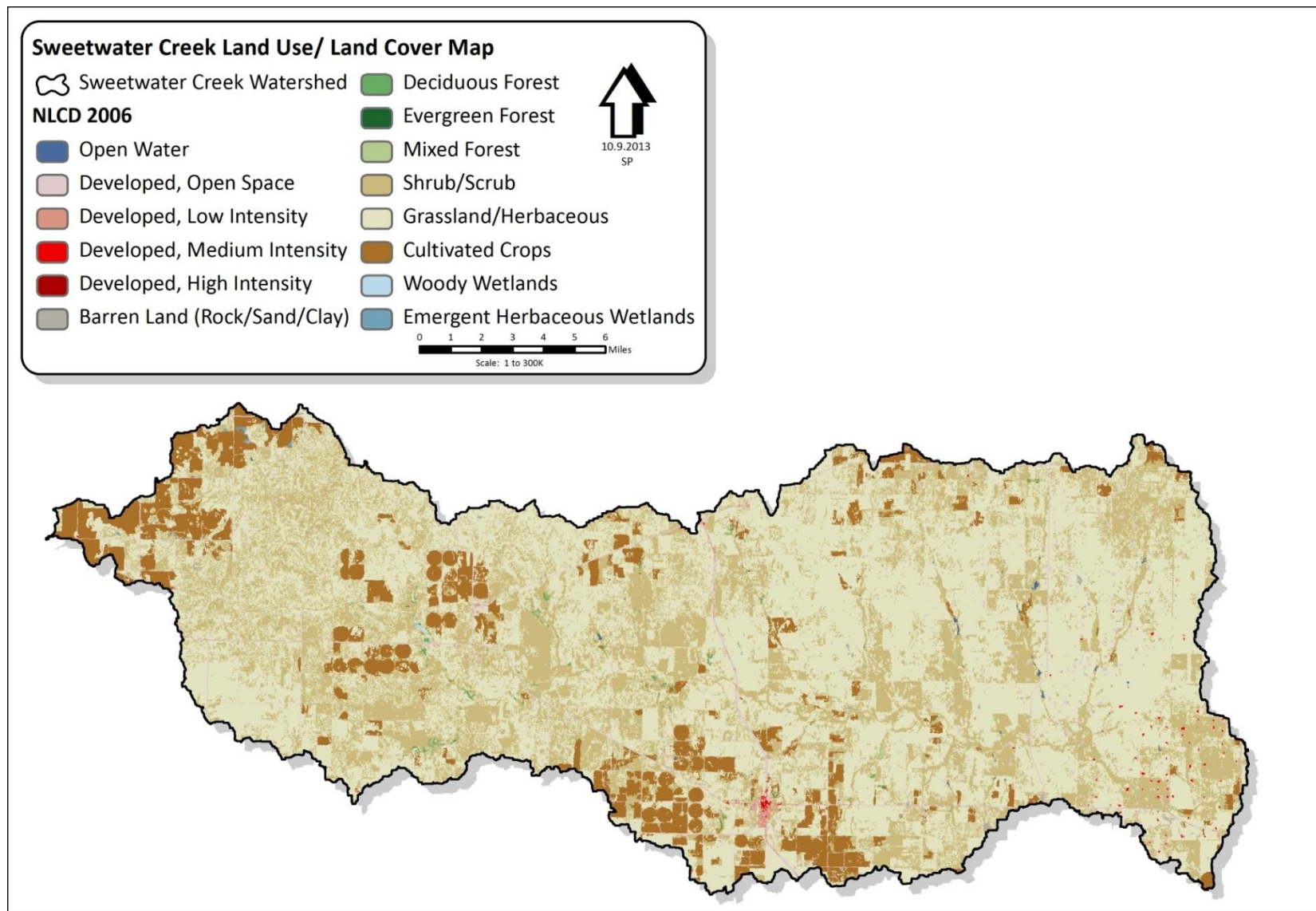


Figure 5.2 Land use/land cover for the Sweetwater Creek watershed. Source: 2006 National Land Cover Database (USGS, 2013).

There are two permitted concentrated animal feeding operations (CAFOs) in the Sweetwater Creek watershed. The Wheeler Cattle Feedlot (TXG920298) is classified as a TPDES large CAFO, and is located immediately south of State Highway 152 and east of County Road 10. The Wheeler Land & Livestock (TXG921147) CAFO is located immediately north of State Highway 152 and west of County Road 12, and is permitted for 52,500 cattle. No water quality compliance violations have been reported for either of these CAFOs (EPA, 2013). The CAFOs are authorized as ‘no discharge’ facilities by the TCEQ, except in those circumstances when a CAFO is subject to a 25-year, 24-hour catastrophic or chronic rainfall event.

Non-Permitted Agricultural Activities and Domesticated Animals

Activities such as livestock grazing close to waterbodies and agricultural use of manure as fertilizer, can contribute *E. coli* to nearby waterbodies. Livestock statistics were obtained from United States Department of Agriculture (USDA) National Agricultural Statistics Service website (USDA, 2007). The majority of the Sweetwater watershed is within Gray and Wheeler Counties with very small portions extending into Roberts and Hemphill Counties (Figure 5.1). For estimating livestock numbers, county estimates for Wheeler and Gray Counties were used (Table 5.1). The watershed covers about 5.2 percent of Gray County and 36 percent of Wheeler County. These statistics indicated large numbers of beef cattle in both counties of the watershed.

Table 5.1 Estimated livestock numbers within the Sweetwater Creek watershed based on statistics for Wheeler and Gray Counties adjusted for the percent of the county within the watershed. (Source USDA, 2007).

County	Year	Cattle & Calves (all beef)	All Goats	Horses & ponies	Hogs
Wheeler	2007	91,397	67	508	0
Gray	2007	103,999	109	742	245
Sweetwater Creek Watershed Average	2007	38,311	30	221	13

Domestic pets are another unregulated source of *E. coli* bacteria, particularly dogs, because storm runoff often carries these wastes into streams (EPA, 2009). Assuming a rough estimate of 0.584 dogs per household (AVMA, 2012) and about 1,200 households within the Sweetwater Creek watershed based on 2010 census population data (about 2,500 individuals and 2 individuals per household), there are potentially about 701 dogs within the Sweetwater Creek watershed. Other domestic animals, such as outdoor cats may also contribute.

Wildlife and Feral Hogs

Other possible bacteria contributors include wildlife such as deer, feral hogs, and birds. Between 2005 and 2012, average estimated whitetail deer densities ranged between 9.55 to 44.95 deer per 1,000 acres (TPWD, 2013); and, between 2006 and 2012, average estimated mule deer densities ranged from 3.41 to 6.51 deer per 1000 acres (Gray, 2012a) within the regional management units encompassing the Sweetwater Creek watershed. The Sweetwater Creek watershed is located just

outside of the current pronghorn distribution range (Gray, 2012b). Statewide feral hog densities range from an estimated average of 1.33 to 2.45 hogs per square mile (Agrilife, 2011).

Failing On-Site Sewage Facilities

Septic systems or on-site sewage facilities (OSSFs) are often used in rural areas that do not have the ability to connect to a central wastewater collection system. The 2010 U.S. Census Bureau (USCB) data indicated that of the 1,200 households in the Sweetwater Creek watershed, about 40 percent are outside municipal areas and likely on septic systems.

Historical Review

Government Sources

City of Wheeler

<http://www.wheelertexas.org/>

Wheeler County history noted that Sweetwater Creek was one of the major streams in the county.

Wheeler Historical Museum

<http://www.wheelermuseum.org/>

Nothing significant was found with regard to recreational use of Sweetwater Creek.

City of Pampa

<http://www.cityofpampa.org/index.aspx>

Nothing significant was found.

Library Sources

Wheeler Public Library

Phone: (806) 826-5977

No relevant information found.

Lovett Memorial Library

<http://harringtonlc.org/lovett/>

Phone: (806) 669-5780

No information found.

Newspaper Sources

The Pampa News

<http://www.thepampanews.com/>

Phone: (806) 669-2525

No information found.

County Star News

<http://countystarnews.com/>

Phone: 806-256-2070

No information found.

Internet Searches

The Handbook of Texas Online

<http://www.tshaonline.org/>

Searched the handbook by creek name. Nothing significant was found.

Survey Site Descriptions

Thirty-three sampling sites were located in Segment 0299A (Figure 5.1 and Table 5.2). With the help of cooperating stakeholders, TIAER was able to establish a total of 33 sampling stations throughout the almost 70 mile long segment. Although the optimum number of sampling stations would have been 42, following the RUAA guidelines, acceptance of using only 33 stations was sought and granted from TCEQ. Nine sites were chosen at public road crossings that did not require permission for access to the creek, but did require landowner cooperation to conduct the full 300 meter assessment. It should be noted that at these nine publically accessible locations, there was actually very limited public access at six of the nine sites due to property fences. The remaining 24 privately controlled sites were selected to provide physical characterization of Sweetwater Creek in areas between public access points. Entrances to sites on private lands were limited by fences and locked gates and were often several meters to kilometers from the stream. RUAA surveys were performed May 26-28 and July 28-29 of 2013 at these locations. A brief description of each site follows.

Table 5.2 Description and location of RUAA field survey sites for Sweetwater Creek, Segment 0299A.

* indicates that the site was publically accessible at a road crossing but that further access was limited by fencing of private property.

TCEQ ID	Site ID	Site Description	Latitude	Longitude	Distance from Previous Site (mi)¹	Distance from Confluence (mi)¹	Distance from Upper Reach (mi)¹	Access
	SW001	Sweetwater Creek on private property, 0.25 miles west of State Line Road, East of Wheeler	35.443954	-100.003792	-	0.45	66.85	Private
	SW002	Sweetwater Creek, East of Wheeler, at County Rd 29	35.446533	-100.022742	2.35	2.81	64.49	Public*
	SW003	Sweetwater Creek on private property, 0.62 river miles west of CR 29, east of Wheeler	35.441365	-100.028398	0.62	3.43	63.87	Private
	SW004	Sweetwater Creek on private property, 0.46 river miles Northwest of County Rd 28.East of Wheeler	35.450298	-100.046504	2.33	5.75	61.55	Private
	SW005	Sweetwater Creek on private property, 2.30 miles east of Ranch Road 592, northeast of Wheeler	35.458063	-100.071495	2.85	8.60	58.70	Private
	SW006	Sweetwater Creek on private property, 2.0 miles east of Ranch Road 592 and 3.3 river miles downstream of confluence with Williams Creek, northeast of Wheeler	35.466318	-100.079502	1.41	10.01	57.29	Private
	SW007	Sweetwater Creek on private property, 0.15 river mile west of confluence with Williams Creek. northeast of Wheeler	35.477873	-100.094140	3.46	13.47	53.83	Private
	SW008	Sweetwater Creek on private property, 1.41 river miles east of RR 592, northeast of Wheeler	35.471474	-100.105703	1.63	15.11	52.19	Private

TCEQ ID	Site ID	Site Description	Latitude	Longitude	Distance from Previous Site (mi)¹	Distance from Confluence (mi)¹	Distance from Upper Reach (mi)¹	Access
	SW009	Sweetwater Creek at RR 592, northeast of Wheeler, east of road.	35.472910	-100.120793	1.41	16.52	50.78	Public*
	SW010	Sweetwater Creek on private property, 0.93 river mile upstream RR 592, northeast of Wheeler, on private property	35.477395	-100.132038	0.93	17.45	49.85	Private
	SW011	Sweetwater Creek on private property, 0.10 river mile downstream of CR 22, northeast of Wheeler, on private property	35.469328	-100.146057	1.87	19.32	47.98	Private
	SW012	Sweetwater Creek on private property, 0.42 river mile upstream of CR 22, 0.2 river mile downstream from confluence with Coburn Creek, northeast of Wheeler	35.474517	-100.151486	0.53	19.84	47.46	Private
	SW013	Sweetwater Creek, Northeast of Wheeler, on private property, 1.1 river mile upstream from confluence with Coburn Creek.	35.474586	-100.162442	1.04	20.88	46.42	Private
	SW014	Sweetwater Creek on private property, 1.5 river mile downstream from confluence with Goodlin Creek, northeast of Wheeler	35.482457	-100.182238	2.45	23.34	43.97	Private
	SW015	Sweetwater Creek on CR 18, northeast of Wheeler, east of road	35.486929	-100.218843	3.41	26.74	40.56	Public*
	SW016	Sweetwater Creek on CR 17, northeast of Wheeler, west of road.	35.485544	-100.236763	1.52	28.26	39.04	Public*
	SW017	Sweetwater Creek, on private property, 0.74 river miles west of CR 17, north-northeast of Wheeler near confluence with Jenkins-Jones Creek.	35.489176	-100.247114	0.74	29.00	38.30	Private

TCEQ ID	Site ID	Site Description	Latitude	Longitude	Distance from Previous Site (mi)¹	Distance from Confluence (mi)¹	Distance from Upper Reach (mi)¹	Access
	SW018	Sweetwater Creek on private property, 2 river miles east of Hwy 83, north-northeast of Wheeler	35.489027	-100.262778	1.31	30.31	36.99	Private
	SW019	Sweetwater Creek on private property, 0.84 river mile East of Hwy 83, North of Wheeler,	35.496383	-100.272271	0.54	30.85	36.45	Private
10072	SW020	Sweetwater Creek, north of Wheeler, west of Hwy 83.	35.500476	-100.291368	0.84	31.69	35.61	Public*
	SW021	Sweetwater Creek on private property, 1 river mile west of confluence with Dubbs Creek and 3 river miles west of Hwy 83, northwest of Wheeler	35.500592	-100.318992	3.06	34.75	32.55	Private
	SW022	Sweetwater Creek on private property, 2.09 river miles East of RR 3182, northwest of Wheeler	35.500728	-100.333801	1.35	35.50	31.20	Private
	SW023	Sweetwater Creek, on private property, 0.57 river mile East of RR 3182, northwest of Wheeler	35.505332	-100.353598	1.52	37.62	29.68	Private
	SW024	Sweetwater Creek at RR 3182, northwest of Wheeler, west of road.	35.508284	-100.361771	0.57	38.19	29.11	Public*
	SW025	Sweetwater Creek on private property, 1.5 river mile West of confluence with Russell Creek and 0.2 river mile East of Adobe Creek, southeast of Mobeetie	35.500166	-100.394938	2.89	41.08	25.62	Private
10074	SW026	Sweetwater Creek at Hwy 152, southeast of Mobeetie, west of road.	35.497465	-100.411569	1.70	42.78	24.52	Public*
	SW027	Sweetwater Creek on private property, 0.9 river mile southwest of Hwy 152, south of Mobeetie	35.494157	-100.422387	0.90	43.68	23.62	Private

TCEQ ID	Site ID	Site Description	Latitude	Longitude	Distance from Previous Site (mi)¹	Distance from Confluence (mi)¹	Distance from Upper Reach (mi)¹	Access
	SW028	Sweetwater Creek on private property, 1.46 river mile upstream from confluence with Graham Creek, 2.73 river mile upstream from Hwy 152, south of Mobeetie	35.496861	-100.444134	1.83	45.51	21.79	Private
	SW029	Sweetwater Creek on CR F, northwest of Mobeetie, south of road.	35.532031	-100.474459	4.23	49.74	17.56	Public*
	SW030	Sweetwater Creek, on CR 2, northwest of Mobeetie, west of road	35.566614	-100.504330	5.48	55.22	12.08	Public*
	SW031	Sweetwater Creek on private property, 1.77 river mile east of RR 120 (CR 29) in Gray County Northwest of Mobeetie	35.585865	-100.561449	7.31	62.53	4.77	Private
	SW032	Sweetwater Creek on private property, 0.80 river mile east of RR 120 (CR 29) in Gray County, northwest of Mobeetie	35.585149	-100.571943	0.97	63.50	3.80	Private
	SW033	Sweetwater Creek on Hoffer Rd (CR B) in Gray County, northwest of Mobeetie, north of road.	35.593337	-100.591795	2.58	66.08	1.22	Public*

¹Distances were digitally estimated using the measuring tool in ArcGIS 9.3 with the 2010 NAIP 1-m DOQQs and the NHD stream layer as reference guides.

Site SW001 is located on Sweetwater Creek approximately 0.25 miles west of State Line Road, east of Wheeler, Texas. Site SW001 was only accessible through fenced private property via a cattle guard with landowner permission. The site was selected because of landowner cooperation and the site provided opportunity for characterization of Stream Segment 0299A.

Site SW002 is located on Sweetwater Creek at the bridge crossing on County Road 29, east of Wheeler, Texas. Site SW002 was only accessible with landowner permission through fenced private property via a locked gate with a cattle guard. Public access at this site is very limited due to the property fences being connected to the bridge. The site was selected because of landowner cooperation and the site provided opportunity for characterization of Stream Segment 0299A. This site was also a location for potential public access.

Site SW003 is located on Sweetwater Creek 0.62 river miles west of County Road 29, east of Wheeler, Texas. Site SW003 was only accessible through fenced private property via two cattle guards. The cattle guards have the potential to also include locked gates, which were open during both of the field surveys. The site was selected because of landowner cooperation and the site provided opportunity for characterization of Stream Segment 0299A.

Site SW004 is located on Sweetwater Creek 0.46 river miles northwest of County Road 28, east of Wheeler, Texas. Site SW004 was only accessible through fenced private property via a potentially locked gate with a cattle guard on an oilfield road. The site was selected because of landowner cooperation and the site provided opportunity for characterization of Stream Segment 0299A.

Site SW005 is located on Sweetwater Creek 2.3 miles east of Ranch Road 592, northeast of Wheeler, Texas. Site SW005 was only accessible, with landowner permission, through fenced private property via cattle guards with potentially locked gates. The site was selected because of landowner cooperation and the site provided opportunity for characterization of Stream Segment 0299A.

Site SW006 is located on Sweetwater Creek approximately 2.0 miles east of Ranch Road 592 and 3.3 river miles downstream of the confluence with Williams Creek, northeast of Wheeler, Texas. Site SW006 was only accessible, with landowner permission, through fenced private property via a cattle guard with a potentially locked gate. The site was selected because of landowner cooperation and the site provided opportunity for characterization of Stream Segment 0299A.

Site SW007 is located on Sweetwater Creek approximately 1.5 miles east of Ranch Road 592 and 0.15 river miles west of the confluence with Williams Creek, northeast of Wheeler, Texas. Site SW007 was only accessible, with landowner permission, through fenced private property via a cattle guard with a potentially locked gate. The site was selected because of landowner cooperation and the site provided opportunity for characterization of Stream Segment 0299A.

Site SW008 is located on Sweetwater Creek 1.41 river miles east of Ranch Road 592, northeast of Wheeler, Texas. Site SW008 was only accessible, with landowner permission, through fenced private property via a cattle guard with a potentially locked gate. The site was selected because of

landowner cooperation and the site provided opportunity for characterization of Stream Segment 0299A.

Site SW009 is located on Sweetwater Creek at the bridge crossing Ranch Road 592, northeast of Wheeler, Texas. Site SW009 is only publicly accessible at the area immediately underneath the bridge crossing, approximately 10 meters upstream and downstream of the crossing. To conduct the survey for the full 300-m reach, permission was sought and granted from the downstream private landowner who allowed access through the water gap. The site was selected because of landowner cooperation and the site provided opportunity for characterization of Stream Segment 0299A.

Site SW010 is located on Sweetwater Creek 0.93 river miles upstream of Ranch Road 592, northeast of Wheeler, Texas. Site SW010 was only accessible, with landowner permission, through fenced private property via an oil field road with a cattle guard and locked gate. A second gate was traveled through and the oil field road became a pasture road. The site was selected because of landowner cooperation and the site provided opportunity for characterization of Stream Segment 0299A.

Site SW011 is located on Sweetwater Creek 0.10 river miles east of County Road 22, northeast of Wheeler, Texas. Site SW011 was only accessible through fenced private property via a locked gate with landowner permission. The site was selected because of landowner cooperation and the site provided opportunity for characterization of Stream Segment 0299A.

Site SW012 is located on Sweetwater Creek 0.42 river miles west of County Road 22 and 0.2 river miles east of the confluence with Coburn Creek, northeast of Wheeler, Texas. Site SW012 was only accessible, with landowner permission, through fenced private property via a cattle guard with a potentially locked gate. The site was selected because of landowner cooperation and the site provided opportunity for characterization of Stream Segment 0299A.

Site SW013 is located on Sweetwater Creek 1.10 river miles west of the confluence with Coburn Creek, northeast of Wheeler, Texas. Site SW013 was only accessible, with landowner permission, through fenced private property via a cattle guard with a locked gate. The site was selected because of landowner cooperation and the site provided opportunity for characterization of Stream Segment 0299A.

Site SW014 is located on Sweetwater Creek 1.5 river miles east of the confluence with Goodlin Creek, northeast of Wheeler, Texas. Site SW014 was only accessible, with landowner permission, through fenced private property via a cattle guard with a locked gate. The site was selected because of landowner cooperation and the site provided opportunity for characterization of Stream Segment 0299A.

Site SW015 is located on Sweetwater Creek at the bridge crossing County Road 18, northeast of Wheeler, Texas. Site SW015 is listed as a publicly accessible site but property fences severely limit public access to the stream. SW015 was only accessible through fenced private property with permission from the landowner, which was sought and granted to TIAER field staff. The site was selected because of landowner cooperation and the site provided opportunity for characterization of Stream Segment 0299A.

Site SW016 is located on Sweetwater Creek at the bridge crossing County Road 17, northeast of Wheeler, Texas. Although the site is listed as having public access, property fences up to the edge of the road only allow very limited public access to the stream. Site SW016 was only accessible through a private property fence with permission from the landowner. The site was selected because of landowner cooperation and the site provided opportunity for characterization of Stream Segment 0299A.

Site SW017 is located on Sweetwater Creek 0.74 river miles west of County Road 17, north-northeast of Wheeler, Texas. Site SW017 was only accessible through fenced private property via a locked gate with the landowner serving as an escort. The site was selected because of landowner cooperation and the site provided opportunity for characterization of Stream Segment 0299A.

Site SW018 is located on Sweetwater Creek 2.0 river miles east of State Highway 83, north-northeast of Wheeler, Texas. Site SW018, owned by the same landowner as Site SW017, was only accessible through fenced private property via a locked gate with the landowner serving as an escort. The site was selected because of landowner cooperation and the site provided opportunity for characterization of Stream Segment 0299A.

Site SW019 is located on Sweetwater Creek 0.84 river miles east of State Highway 83, north of Wheeler, Texas. Site SW019, owned by the same landowner as Sites SW017 and SW018, was only accessible through fenced private property via a locked gate with the landowner serving as an escort. The site was selected because of landowner cooperation and the site provided opportunity for characterization of Stream Segment 0299A.

Site SW020 (TCEQ site 10072) is located on Sweetwater Creek just upstream of the bridge crossing State Highway 83, north of Wheeler, Texas. Site SW020 was only accessible through fenced private property via a gate with the landowner permission. The site was selected because of landowner cooperation and the site provided opportunity for characterization of Stream Segment 0299A.

Site SW021 is located on Sweetwater Creek 3.0 river miles west of State Highway 83 and 1.0 river miles west of the confluence with Dubbs Creek, northwest of Wheeler, Texas. Site SW021 was only accessible, with landowner permission, through fenced private property via a cattle guard and additional gates within the property. The site was selected because of landowner cooperation and the site provided opportunity for characterization of Stream Segment 0299A.

Site SW022 is located on Sweetwater Creek 2.09 river miles east of Ranch Road 3182, northwest of Wheeler, Texas. Site SW022 was only accessible, with landowner permission, through fenced private property via a cattle guard with a potentially locked gate. Driving along pasture roads, TIAER personnel had to travel through another gated fence to reach the site. The site was selected because of landowner cooperation and the site provided opportunity for characterization of Stream Segment 0299A.

Site SW023 is located on Sweetwater Creek 0.57 river miles east of Ranch Road 3182, northwest of Wheeler, Texas. Site SW023 was only accessible through fenced private property via a gate with the landowner permission. The site was selected because of landowner cooperation and the site provided opportunity for characterization of Stream Segment 0299A.

Site SW024 is located on Sweetwater Creek on the west side of the bridge crossing Ranch Road 3182, northwest of Wheeler Texas. Site SW024 was only accessible over an electrified private property fence with landowner permission. The site is only publicly accessible in the areas between the bridge crossing and the property fence lines, approximately 60 meters total. The site was selected because of landowner cooperation and the site provided opportunity for characterization of Stream Segment 0299A.

Site SW025 is located on Sweetwater Creek 1.5 river miles west of the confluence with Russell Creek and 0.2 river miles east of the confluence with Adobe Creek, southeast of Mobeetie, Texas. Site SW025 was only accessible, with landowner permission, through fenced private property via a cattle guard with a potentially locked gate and up to six internal gates. The site was selected because of landowner cooperation and the site provided opportunity for characterization of Stream Segment 0299A.

Site SW026 is located on Sweetwater Creek at the bridge crossing State Highway 152, southeast of Mobeetie, Texas. Site SW026 was accessed through fenced private property via a wire gate with permission from the landowner. Although the site is listed as having public access, access is very limited due the private land fencing. The site was selected because of landowner cooperation and the site provided opportunity for characterization of Stream Segment 0299A.

Site SW027 is located on Sweetwater Creek 0.9 river miles southwest of State Highway 152, south of Mobeetie, Texas. Site SW027 was only accessible, with landowner permission, through fenced private property via a cattle guard with a potentially locked gate. The site was selected because of landowner cooperation and the site provided opportunity for characterization of Stream Segment 0299A.

Site SW028 is located on Sweetwater Creek 1.46 river miles west of the confluence with Graham Creek and 2.73 river miles west of State Highway 152, south of Mobeetie, Texas. Site SW028 was only accessible through fenced private property via gates with permission from the landowner. The site was selected because of landowner cooperation and the site provided opportunity for characterization of Stream Segment 0299A.

Site SW029 is located on Sweetwater Creek at the culvert crossing on County Road F, northwest of Mobeetie, Texas. Although the site is listed as having public access, the access is very limited due to the private property fences coming almost to the edge of the culvert crossing. Site SW029 was accessed through fenced private property with permission from the landowner to cross the fence. The site was selected because of landowner cooperation and the site provided opportunity for characterization of Stream Segment 0299A. Landowners have noted the stream is generally dry from SW029 upstream to SW033.

Site SW030 is located on Sweetwater Creek at the culvert crossing on County Road 2, northwest of Mobeetie, Texas. Although the site is listed as being publicly accessible, access to the stream is very limited due to the property fences. Site SW030 was accessed through fenced private property with permission from the landowner to cross the fence. The site was selected because of landowner cooperation and the site provided opportunity for characterization of Stream Segment 0299A.

Site SW031 is located on Sweetwater Creek 1.77 river miles east of Ranch Road 120 (County Road 29), northwest of Mobeetie, Texas. Site SW031 was only accessible, with landowner permission, through fenced private property via a cattle guard with a potentially locked gate. The site was selected because of landowner cooperation and the site provided opportunity for characterization of Stream Segment 0299A.

Site SW032 is located on Sweetwater Creek 0.8 river miles east of Ranch Road 120 (County Road 29), northwest of Mobeetie, Texas. Site SW032, owned by the same landowner as Site SW031, was only accessible, with permission, through fenced private property via a cattle guard with a potentially locked gate. The site was selected because of landowner cooperation and the site provided opportunity for characterization of Stream Segment 0299A.

Site SW033 is located on Sweetwater Creek at the culvert crossing Hoffer Road (County Road B), northwest of Mobeetie, Texas. Although the site is listed as having public access, access is very limited due to property fences. Site SW033 was accessed through fenced private property with permission from the landowner to cross the fence. The site was selected because of landowner cooperation and the site provided opportunity for characterization of Stream Segment 0299A.

Field Survey Results and Discussions

General Description of RUAA Survey Sites and Conditions for Segment 0299A

The Sweetwater Creek RUAA surveys were conducted on May 26-28, 2013 and July 28-29, 2013 at all thirty-three sites. The surveys were performed on weekdays, weekends, or holidays at opportune times to observe recreational activities. Air temperatures prior and during both the first and second surveys were above 21°C (70°F) indicated by the RUAA guidelines as warm enough to promote recreational activities (Tables 5.3 and 5.4). In the 30 days prior to the first survey, 0.85 inches of precipitation fell, while 4.37 inches fell 30 days prior to the second survey. While temperatures on the survey dates were warmer in May than in July, average temperatures in the 30 days prior to the surveys were much warmer in July than in May (Tables 5.3 and 5.4). The Palmer Drought Severity Index (PDSI) represented extreme drought conditions during the first survey in May 2013 and moderate drought conditions during the second survey in July 2013 (TWDB, 2013).

A summary of the RUAA field survey results is presented in the following tables:

- Table 5.5 describes the stream channel and corridor characteristics at each site.
- Table 5.6 notes the average thalweg depth by site during each survey and the access to the stream, whether public or private, and the ease of bank access.
- Tables 5.7 and 5.8 document the maximum, minimum, and average stream widths at each site for each survey and observed flow conditions.
- Tables 5.9 and 5.10 note stream aesthetics, wildlife observations and tracks, and the presence of garbage by site observed during each site and survey.

Physical descriptions of each site follow these tables along with selected photos showing notable characteristics of each site. Overall thalweg depth averaged 0.26 m during the first survey and 0.09 m during the second survey. Access to the stream down the bank was moderately easy to

easy in most locations due low banks and grassy vegetation. The dominant substrate was sand and the stream corridor was largely lined with shrubs, grasses, and forbs. The maximum stream width encountered was 14 m during the first survey in May 2013 and 20 m during the second survey in July. Flow conditions were largely normal in May with dry conditions encountered only at the most upstream survey sites. Dry or no flow conditions were noted at most survey sites in July. The water surface was generally clear in color. Tracks observed most often included cattle, raccoon, deer, and canine. Trash was rarely observed at most survey site and when observed was predominantly typical plastics and aluminum cans. No recreation was directly observed during either of the field surveys and signs of potential recreation were observed at only a couple of sites which include fishing equipment.

**Table 5.3 Rainfall records with maximum and minimum temperature for Pampa, Texas
30 days prior to the first RUAA survey initiated on May 26, 2013.**

Survey dates are highlighted in gray. Rainfall Data from Wheeler School District - Emergency Management Coordinator Ken Daughtry.

Date	Daily Precipitation (in)	Temperature (°F)	Temperature (°F)
26-Apr-13	0	81	54
27-Apr-13	0	79	48
28-Apr-13	0	89	42
29-Apr-13	0	90	54
30-Apr-13	0	91	56
1-May-13	0.02	68	32
2-May-13	0	48	31
3-May-13	0	66	25
4-May-13	0	66	31
5-May-13	0	67	32
6-May-13	0	73	42
7-May-13	0	81	48
8-May-13	0.02	85	54
9-May-13	0.27	76	48
10-May-13	0.28	67	49
11-May-13	0	74	48
12-May-13	0	81	45
13-May-13	0	89	57
14-May-13	0	86	58
15-May-13	0	84	57
16-May-13	0	85	52
17-May-13	0	87	57
18-May-13	0	97	66
19-May-13	0	84	57
20-May-13	0	81	55
21-May-13	0.26	70	50
22-May-13	0	86	48
23-May-13	0	79	56
24-May-13	0	86	59
25-May-13	0	85	59
26-May-13	0	94	63
27-May-13	0	98	69
28-May-13	0	93	66

**Table 5.4 Rainfall records with maximum and minimum temperature for Pampa, Texas
30 days prior to the second RUAA survey initiated on July 28, 2013.**

Survey dates are highlighted in gray. Rainfall Data from Wheeler School District - Emergency Management Coordinator Ken Daughtry.

Date	Daily Precipitation (in)	Temperature (°F)	Temperature (°F)
28-Jun-13	0	98	69
29-Jun-13	0	93	70
30-Jun-13	0.04	87	63
1-Jul-13	0	81	57
2-Jul-13	0	82	52
3-Jul-13	0	80	62
4-Jul-13	0	88	61
5-Jul-13	0	94	64
6-Jul-13	0.01	95	71
7-Jul-13	0	95	70
8-Jul-13	0	97	69
9-Jul-13	0	98	73
10-Jul-13	0	97	75
11-Jul-13	0.06	95	69
12-Jul-13	0	99	73
13-Jul-13	0	100	70
14-Jul-13	0.26	83	59
15-Jul-13	0.42	76	59
16-Jul-13	1.74	71	60
17-Jul-13	0.24	80	65
18-Jul-13	0	81	64
19-Jul-13	0	87	65
20-Jul-13	0	89	68
21-Jul-13	0	92	69
22-Jul-13	0	93	68
23-Jul-13	0	95	70
24-Jul-13	0	90	66
25-Jul-13	1.5	78	63
26-Jul-13	0.1	84	65
27-Jul-13	0	87	58
28-Jul-13	0	88	63
29-Jul-13	0	95	68

Table 5.5 Stream Channel and corridor appearance for each site sampled along Sweetwater Creek Segment 0299A.

Site Number	Stream Channel Appearance	Dominant Substrate	Corridor Appearance	Riparian Size	Park	Landscape Surroundings
SW001	Natural	Sand	Pasture	Large	No	Native pasture
SW002	Natural	Sand	Pasture on right Shrubs on left	Large	No	Native pasture
SW003	Natural	Sand	Shrubs	Large	No	Native pasture
SW004	Natural	Sand	Shrubs	Large	No	Native; old shale pit; new oil rig
SW005	Natural	Sand	Shrubs	Large	No	Native; improved pasture
SW006	Natural	Sand	Upper ½ pasture Lower ½ shrubs	Large	No	Native pasture
SW007	Natural	Sand	Shrubs with trees	Large	No	Native pasture
SW008	Natural	Sand	Shrubs with trees	Large	No	Native pasture
SW009	Natural	Mud/Clay	Pasture on right Trees on left	Large	No	Native and improved pasture
SW010	Natural	Sand	Shrubs with trees	Large	No	Native and improved pasture
SW011	Natural	Sand	Shrubs with trees	Large	No	Native and improved pasture
SW012	Natural	Sand	Shrubs with trees	Large	No	Native and improved pasture;
SW013	Natural	Sand	Grasses with shrubs; few trees	Large	No	Native and improved pasture
SW014	Natural	Sand with mud/clay	Shrubs with trees	Large	No	Native and improved pasture

Site Number	Stream Channel Appearance	Dominant Substrate	Corridor Appearance	Riparian Size	Park	Landscape Surroundings
SW015	Natural	Sand	Grasses and forbs with trees	Large	No	Native pasture
SW016	Natural	Sand	Grasses with trees	Large	No	Native pasture
SW017	Natural	Sand	Shrubs with trees	Large	No	Native and improved pasture
SW018	Natural	Sand	Grasses and forbs with trees	Large	No	Native and improved pasture
SW019	Natural	Sand	Grasses and forbs with trees	Large	No	Native and improved pasture
SW020	Natural	Sand	Grasses and forbs	Large	No	Native pasture
SW021	Natural	Sand	Grasses and forbs	Large	No	Native pasture
SW022	Natural	Sand	Grasses and forbs with trees at banks	Large	No	Native and improved pasture
SW023	Natural	Sand	Grasses and forbs with few shrubs	Large	No	Native pasture
SW024	Natural	Mud/Clay	Grasses and forbs with few shrubs	Large	No	Native pasture
SW025	Natural	Mud/Clay	Grasses and forbs with few shrubs	Large	No	Native pasture
SW026	Natural	Mud/Clay	Grasses and forbs with few shrubs	Large	No	Native pasture
SW027	Natural	Sand	Grasses with few trees	Large	No	Native and improved pasture
SW028	Natural	Sand with mud/clay	Grasses and forbs with few shrubs	Large	No	Native and improved pasture

Site Number	Stream Channel Appearance	Dominant Substrate	Corridor Appearance	Riparian Size	Park	Landscape Surroundings
SW029	Natural	Sand	Shrubs and trees	Large	No	Native and improved pasture
SW030	Natural	Sand	Grasses and forbs with few shrubs	Large	No	Native pasture
SW031	Natural	Sand	Grasses with few shrubs and trees	Large	No	Native pasture
SW032	Natural	Sand	Grasses with few shrubs and trees	Large	No	Native pasture
SW033	Natural	Mud/Clay	Grasses	Large	No	Native pasture

Table 5.6 Thalweg depth, stream flow type, and site accessibility during the two surveys of Sweetwater Creek (0299A).

Stream flow type represents TCEQ descriptions (TCEQ, 2012). Under general access, * indicates that the site was publically accessible at a road crossing but that further access was limited by fencing of private property. For Bank Access, E = Easy, ME = Moderately Easy, MD = Moderately Difficult, D = Difficult.

Site	Reach length (m)	# of Transects	# of Recreational Areas at Site	Avg. Site Thalweg Depth (m) for Trip 1	Avg. Site Thalweg Depth (m) for Trip 2	Stream Flow Type	General Access	Bank Access
SW001	300	11	0	0.31	0.00	Perennial	Public*	ME
SW002	300	11	0	0.30	0.00	Perennial	Public*	E
SW003	300	11	0	0.28	0.11	Perennial	Private	ME
SW004	300	11	0	0.28	0.00	Perennial	Private	MD
SW005	300	11	0	0.31	0.00	Perennial	Private	ME
SW006	300	11	0	0.29	0.00	Perennial	Private	ME
SW007	300	11	0	0.28	0.12	Perennial	Private	MD
SW008	300	11	0	0.27	0.06	Perennial	Private	ME
SW009	300	11	0	0.39	0.24	Perennial	Public*	MD
SW010	300	11	0	0.28	0.10	Perennial	Private	MD
SW011	300	11	0	0.26	0.09	Perennial	Private	MD
SW012	300	11	0	0.31	0.04	Perennial	Private	ME
SW013	300	11	0	0.35	0.08	Perennial	Private	MD
SW014	300	11	0	0.20	0.00	Perennial	Private	ME
SW015	300	11	0	0.18	0.11	Perennial	Public*	E
SW016	300	11	0	0.20	0.00	Perennial	Public*	E

Site	Reach length (m)	# of Transects	# of Recreational Areas at Site	Avg. Site Thalweg Depth (m) for Trip 1	Avg. Site Thalweg Depth (m) for Trip 2	Stream Flow Type	General Access	Bank Access
SW017	300	11	0	0.13	0.00	Perennial	Private	ME
SW018	300	11	0	0.21	0.00	Perennial	Private	ME
SW019	300	11	0	0.19	0.00	Perennial	Private	ME
SW020	300	11	0	0.29	0.29	Perennial	Private	ME
SW021	300	11	0	0.22	0.02	Perennial	Private	E
SW022	300	11	0	0.18	0.00	Perennial	Private	E
SW023	300	11	0	0.35	0.20	Perennial	Private	ME
SW024	300	11	0	>1.0	0.70	Perennial	Public*	E
SW025	300	11	0	0.28	0.06	Perennial	Private	ME
SW026	300	11	0	>0.56	>0.54	Perennial	Public*	ME
SW027	300	11	0	0.18	0.08	Perennial	Private	E
SW028	300	11	0	0.33	0.19	Perennial	Private	ME
SW029	300	11	0	0.03	0.00	Perennial	Public*	ME
SW030	300	11	0	0.00	0.00	Perennial	Public*	ME
SW031	300	11	0	0.00	0.00	Perennial	Private	ME
SW032	300	11	0	0.00	0.00	Perennial	Private	E
SW033	300	11	0	0.00	0.02	Perennial	Public*	E

Table 5.7 Description of surveyed stream sites along Sweetwater Creek during first survey performed in May 2013.

Site Number	Maximum Width (m)	Minimum Width (m)	Typical Average Width (m)	Observed Flow
SW001	5.5	2.6	4.0	Normal
SW002	5.0	2.0	2.5	Normal
SW003	11	2.4	4.0	Normal
SW004	6.4	3.0	4.0	Low
SW005	10	2.5	3.5	Normal
SW006	11	3.5	5.0	Normal
SW007	7.0	3.0	4.0	Normal
SW008	9.0	2.0	4.0	Normal
SW009	6.5	4.5	5.0	Normal
SW010	4.2	2.3	3.6	Normal
SW011	4.0	1.1	3.0	Normal
SW012	5.7	2.9	4.2	Normal
SW013	6.0	3.0	4.2	Normal
SW014	4.8	2.9	3.5	Normal
SW015	3.7	2.2	3.2	Normal
SW016	3.6	1.8	3.0	Normal
SW017	4.8	0.40	2.4	Normal
SW018	5.2	0.90	2.0	Normal
SW019	4.1	2.0	2.7	Normal
SW020	12	0.90	4.0	Normal
SW021	11	2.8	5.0	Normal
SW022	11	2.1	2.5	Normal
SW023	12	0.60	4.2	Normal
SW024	14	3.5	4.0	Normal
SW025	5.2	1.8	2.3	Normal
SW026	14	0.50	4.5	Normal
SW027	11	2.6	3.4	Normal
SW028	14	1.7	7.5	Normal
SW029	4.5	0.00	3.5	No Flow
SW030	0.00	0.00	0.00	Dry
SW031	0.00	0.00	0.00	Dry
SW032	0.00	0.00	0.00	Dry
SW033	0.00	0.00	0.00	Dry

Table 5.8 Description of surveyed stream sites along Sweetwater Creek during second survey performed in July 2013.

Site Number	Maximum Width (m)	Minimum Width (m)	Typical Average Width (m)	Observed Flow
SW001	0.00	0.00	0.00	Dry
SW002	4.5	0.00	0.00	No Flow
SW003	8.5	0.65	2.0	Low
SW004	0.00	0.00	0.00	Dry
SW005	0.00	0.00	0.00	Dry
SW006	0.00	0.00	0.00	Dry
SW007	2.0	0.40	1.0	Low
SW008	3.3	0.46	1.2	Low
SW009	4.7	0.90	3.6	Normal
SW010	3.7	0.60	1.8	Low
SW011	3.0	0.00	0.00	No Flow
SW012	3.7	0.00	0.00	No Flow
SW013	3.5	0.40	1.5	Low
SW014	0.00	0.00	0.00	Dry
SW015	3.0	1.0	2.0	Low
SW016	0.00	0.00	0.00	Dry
SW017	0.00	0.00	0.00	Dry
SW018	0.00	0.00	0.00	Dry
SW019	0.00	0.00	0.00	Dry
SW020	14	0.50	2.5	Low
SW021	8.0	0.00	0.00	No Flow
SW022	0.00	0.00	0.00	Dry
SW023	11	0.00	0.50	No Flow
SW024	13	1.2	6.0	Low
SW025	1.3	0.0	0.00	No Flow
SW026	19	1.0	3.0	Normal
SW027	20	1.4	1.5	Low
SW028	11	0.00	1.0	No Flow
SW029	0.00	0.00	0.00	Dry
SW030	0.00	0.00	0.00	Dry
SW031	0.00	0.00	0.00	Dry
SW032	0.00	0.00	0.00	Dry
SW033	3.4	0.00	0.00	No Flow

Table 5.9 Stream aesthetics along Sweetwater Creek during first survey performed in May 2013.

From Field Data Sheet – Section F: A = absent, R = rare, C = common, Ab = abundant, N = none, NW = no water, SP = slight presence, MP = moderate presence, LP = large presence.

Site	Aquatic Vegetation	Algae Cover	Odor	Color	Bottom Deposit	Water Surface	Reptiles	Water Dependent Birds	Mammals	Evidence of wildlife	Large garbage in Channel	Small garbage in Channel	Bank garbage
SW001	C	R	N	Clear	Fine sediment	Clear	N	N	N	Tracks/Fecal	R	R	R
SW002	C	R	N	Green	Fine sediment	Clear	N	N	MP	Tracks/Fecal	N	R	R
SW003	R	C	N	Green	Fine sediment	Clear	N	N	N	Tracks/Fecal	N	R	R
SW004	C	C	N	Clear	Fine sediment	Clear	N	N	MP	Tracks/Fecal	N	R	R
SW005	C	C	N	Clear	Fine sediment	Clear	N	N	N	Tracks/Fecal	R	R	R
SW006	R	R	N	Green	Fine sediment	Clear	N	N	SP	Tracks/Fecal	N	R	N
SW007	R	C	N	Clear	Fine sediment	Clear	N	N	SP	Tracks/Fecal	N	N	N
SW008	C	R	N	Clear	Fine sediment	Clear	N	N	N	Tracks/Fecal	N	R	R
SW009	Ab	C	C	Brown	Sludge	Clear/Scum/Foam	N	N	SP	Tracks/Fecal/Nests	N	C	C
SW010	C	Ab	N	Clear	Fine sediment	Clear/Scum	SP	N	MP	Tracks/Fecal	N	R	R
SW011	C	C	N	Clear	Fine sediment	Clear	N	N	SP	Tracks/Fecal	R	R	N
SW012	C	Ab	N	Clear	Fine sediment	Clear	SP	N	SP	Tracks/Fecal	N	N	N
SW013	Ab	Ab	N	Clear	Fine sediment	Clear	SP	SP	N	Tracks/Fecal	N	N	N
SW014	C	C	N	Clear	Fine sediment	Clear	N	N	N	Tracks/Fecal	N	N	R
SW015	C	C	N	Clear	Fine sediment	Clear	SP	N	N	Tracks/Fecal	N	R	N
SW016	R	Ab	N	Clear	Fine sediment	Clear	N	N	SP	Tracks/Fecal	R	N	N

Site	Aquatic Vegetation	Algae Cover	Odor	Color	Bottom Deposit	Water Surface	Reptiles	Water Dependent Birds	Mammals	Evidence of wildlife	Large garbage in Channel	Small garbage in Channel	Bank garbage
SW017	R	R	N	Clear	Fine sediment	Clear	N	N	SP	Tracks/Fecal	N	N	N
SW018	C	Ab	N	Clear	Fine sediment	Clear	N	N	N	Tracks/Fecal	N	N	N
SW019	C	A	N	Clear	Fine sediment	Clear	N	N	N	Tracks/Fecal	N	N	N
SW020	Ab	Ab	C	Clear	Sludge	Clear	SP	N	N	Tracks/Fecal	N	R	R
SW021	C	Ab	N	Clear	Fine sediment	Clear	N	N	SP	Tracks/Fecal	N	N	N
SW022	Ab	Ab	N	Clear	Fine sediment	Clear	N	N	SP	Tracks/Fecal	N	N	N
SW023	Ab	R	N	Clear	Fine sediment	Clear	SP	N	SP	Tracks/Fecal	N	N	N
SW024	Ab	C	N	Clear	Sludge	Clear	N	N	N	Tracks/Fecal	N	N	N
SW025	Ab	R	N	Clear	Fine sediment	Clear	N	SP	SP	Tracks/Fecal	R	N	N
SW026	Ab	C	N	Clear	Sludge	Clear	SP	N	N	Tracks/Fecal/Nests	N	N	R
SW027	Ab	C	N	Clear	Fine sediment	Clear	N	N	N	Tracks/Fecal	N	N	R
SW028	Ab	C	N	Clear	Sludge	Clear	N	N	SP	Tracks/Fecal	N	N	N
SW029	R	R	N	Clear	Fine sediment	Clear	N	N	N	Tracks/Fecal	R	R	R
SW030	A	A	N	NA	Fine sediment	NA	N	N	N	Tracks/Fecal	N	R	N
SW031	A	A	N	NA	Fine sediment	NA	N	N	N	Tracks/Fecal	R	R	N
SW032	A	A	N	NA	Fine sediment	NA	N	N	SP	Tracks/Fecal	N	N	N
SW033	A	A	N	NA	Fine sediment	NA	N	N	N	Tracks/Fecal	N	N	N

Table 5.10 Stream aesthetics along Sweetwater Creek during second survey performed in July 2013.

From Field Data Sheet – Section F: A = absent, R = rare, C = common, Ab = abundant, N = none, NW = no water, SP = slight presence, MP = moderate presence, LP = large presence.

Site	Aquatic Vegetation	Algae Cover	Odor	Color	Bottom Deposit	Water Surface	Reptiles	Water Dependent Birds	Mammals	Evidence of wildlife	Large garbage in Channel	Small garbage in Channel	Bank garbage
SW001	C	A	N	NA	Fine sediment	NA	N	N	N	Tracks/Fecal	N	R	N
SW002	R	A	N	Clear	Fine sediment	Clear	N	N	N	Tracks/Fecal	N	R	N
SW003	R	A	C	Brown	Fine sediment	Clear	N	N	N	Tracks/Fecal	R	R	R
SW004	C	A	N	NA	Fine sediment	NA	N	N	MP	Tracks/Fecal	N	R	N
SW005	C	A	N	NA	Fine sediment	NA	N	N	N	Tracks/Fecal	N	R	N
SW006	R	A	R	NA	Fine sediment	NA	N	N	SP	Tracks/Fecal	N	R	N
SW007	C	A	R	Clear	Fine sediment	Clear	SP	N	MP	Tracks/Fecal	N	N	N
SW008	R	R	N	Clear	Fine sediment	Clear	SP	N	SP	Tracks/Fecal	N	R	N
SW009	Ab	R	N	Clear	Fine sediment	Clear/Scum/Foam	SP	N	SP	Tracks/Fecal	N	C	R
SW010	R	R	N	Clear	Fine sediment	Clear	SP	N	SP	Tracks/Fecal	N	R	N
SW011	C	A	N	Clear	Fine sediment	Clear	SP	N	SP	Tracks/Fecal	N	R	R
SW012	C	R	R	Clear	Fine sediment	Clear	N	N	N	Tracks/Fecal	N	N	N
SW013	C	R	N	Clear	Fine sediment	Clear/Scum/Foam	N	N	N	Tracks/Fecal	N	N	N
SW014	R	A	N	NA	Fine sediment	NA	N	N	N	Tracks/Fecal/Nests	N	N	N
SW015	C	R	N	Clear	Fine sediment	Clear	N	N	N	Tracks/Fecal	N	N	N
SW016	R	A	N	NA	Fine sediment	NA	N	N	N	Tracks/Fecal	N	N	N

Site	Aquatic Vegetation	Algae Cover	Odor	Color	Bottom Deposit	Water Surface	Reptiles	Water Dependent Birds	Mammals	Evidence of wildlife	Large garbage in Channel	Small garbage in Channel	Bank garbage
SW017	A	A	N	NA	Fine sediment	NA	N	N	MP	Tracks/Fecal	N	N	R
SW018	R	A	N	NA	Fine sediment	NA	N	N	N	Tracks/Fecal	N	N	N
SW019	R	A	N	NA	Fine sediment	NA	N	N	N	Tracks/Fecal	N	N	N
SW020	Ab	A	N	Clear	Fine sediment	Scum/Foam	N	N	N	Tracks/Fecal	N	N	N
SW021	C	A	N	Clear	Fine sediment	Clear	N	N	MP	Tracks/Fecal	N	N	N
SW022	C	A	N	NA	Fine sediment	NA	N	N	MP	Tracks/Fecal	N	N	N
SW023	Ab	R	N	Clear	Fine sediment	Clear	SP	N	MP	Tracks/Fecal	N	N	N
SW024	Ab	R	N	Clear	Fine sediment	Clear	N	N	N	Tracks/Fecal	N	N	N
SW025	Ab	A	N	Clear	Fine sediment	Clear	N	N	N	Tracks/Fecal	N	N	N
SW026	Ab	R	R	Clear	Sludge	Clear	N	N	N	Tracks/Fecal	N	R	N
SW027	Ab	C	N	Clear	Fine sediment	Clear	SP	N	N	Tracks/Fecal	N	N	N
SW028	Ab	A	N	Clear	Fine sediment	Clear	N	N	SP	Tracks/Fecal	N	N	N
SW029	R	A	N	Brown	Fine sediment	Clear	N	N	N	Tracks/Fecal	R	R	N
SW030	A	A	N	NA	Fine sediment	NA	N	N	MP	Tracks/Fecal/Nests	N	R	N
SW031	A	A	N	NA	Fine sediment	NA	N	N	N	Tracks/Fecal/Nests	R	N	N
SW032	A	A	N	NA	Fine sediment	NA	N	N	N	Tracks/Fecal	R	N	N
SW033	A	A	N	Brown	Fine sediment	Clear	N	N	N	Tracks/Fecal	N	N	N

Physical Description of SW001

Sweetwater Creek at site SW001 was visited on May 26 and July 29, 2013. This site, located east of Wheeler, Texas in Wheeler County, was accessible only through private lands that were fenced with a cattle guard and potentially locked gate. After entering the private property over the cattle guard, TIAER personnel drove approximately 0.4 miles down an oil field road to reach the site. The site is located in a pasture dominated corridor with a few trees and shrubs spread throughout the reach (Table 5.5). At the site, access to the stream was moderately easy, depending on the location along the bank (Table 5.6). Some banks were gently sloping while others were very steep. Figures 5.3 and 5.4 depict the appearance of the site during each of the surveys.



Figure 5.3 Photograph of Sweetwater Creek Site SW001 taken on May 26, 2013. The downstream view of the 300-m transect.



Figure 5.4 Photograph of Sweetwater Creek Site SW001 taken on July 29, 2013. The upstream view of the 300-m transect.

Site SW001 was wadeable for the entire 300-m reach length. During the first survey in May, the shallow water, average thalweg of 0.31 meters, and the sandy substrate made for easy wading. During the second survey in July, the lack of any water made walking in the streambed easy. Figures 5.3 and 5.4 represent the site with and without the presence of water. Stream widths ranged from 5.5 m to 2.6 m during the first survey and 0 m during the second survey (Tables 5.7 and 5.8).

Aesthetic appearance of the water and wildlife observations for the site during each survey have been previously provided in Tables 5.9 and 5.10, respectively. There were no vertebrates or mammals observed during either survey. Tracks observed during each trip consisted of cattle, horse, deer, canine, and bird. Various types of feces were also found throughout the reach. Aquatic vegetation was common during both of the surveys, while algae was rare during the first survey and absent during the second survey due to the lack of water. Trash observed was rare to non-existent. When encountered, the trash consisted of typical plastic cups and bottles with occasional pieces of metal and tires. No evidence of human presence or recreation was observed within the reach.

Physical Description of SW002

Sweetwater Creek at site SW002 was visited on May 26 and July 29, 2013. This site, located east of Wheeler, Texas in Wheeler County, was accessible through private lands that were fenced with a cattle guard and potentially locked gate. Although the site is listed as being publically accessible, access is very limited due to the property fences attaching to the bridge (Figure 5.5). With

landowner permission, TIAER personnel entered private property over a cattle guard and drove approximately 40 yards through the pasture to reach the site. The right-bank corridor was pasture dominated and the left-bank corridor was shrub dominated (Table 5.5). At the site, access to the stream was easy (Table 5.6), depending on the location to enter the stream. There were banks throughout the reach which were steep and more treacherous. Figures 5.5 and 5.6 depict the appearance of the site during each of the surveys.



Figure 5.5 Photograph of Sweetwater Creek Site SW002 taken on July 29, 2013. The upstream view of the 150-m transect.

Site SW002 was wadeable for the entire 300-m reach length. Average thalweg was from 0.30 m during the first survey to 0.0 m during the second survey when the stream was mainly dry (Table 5.6). During the second survey, there were small pockets of water encountered, however, only one transect yielded a measureable water depth. During both surveys, the shallow water depths and sandy substrate made wading in the stream channel easy. Two tree obstruction were encountered at the 30-m and 265-m transects, which would make boating difficult. Stream widths varied from 5.0 to 2.0 m during the first survey and 4.5 to 0 m during the second survey (Tables 5.7 and 5.8).



Figure 5.6 Photograph of Sweetwater Creek Site SW002 taken on May 26, 2013. The downstream view of the 150-m transect.

Aesthetic appearance of the water and wildlife observations for the site during each survey have been previously provided in Tables 5.9 and 5.10, respectively. There was a moderate presence of cattle observed during the first survey. No other mammals or vertebrates were observed during either survey. Tracks observed during each trip consisted of cattle, deer, raccoon, and bird. Various types of feces were also found throughout the reach. Aquatic vegetation was common during the first survey and rare during the second survey. Algae was rare to absent from the first survey to the second survey. The water color was slightly green during the first survey with no surface scum or foam. Trash observed was rare to non-existent throughout the reach. When encountered, the trash consisted of typical plastic cups and bottles with one occurrence of concrete blocks found immediately upstream of the bridge crossing. No evidence of human presence or recreation was found during either survey.

Physical Description of SW003

Sweetwater Creek at site SW003 was visited on May 26 and July 29, 2013. This site, located east of Wheeler, Texas in Wheeler County, was accessible only through private lands that were fenced with cattle guards and potentially locked gates. With landowner permission, TIAER personnel entered private property over two cattle guards and drove approximately 300 yards on a gravel road through the pasture to reach the site. The site is located in a shrub dominated corridor (Table 5.5). At the site, the gravel road continues through the stream and allowed easy access to the stream (Figure 5.7). At other locations throughout the reach, stream access was moderately easy due to the presence of trees, shrubs, and sometimes moderately steep banks (Table 5.6). Figures 5.7 and 5.8 depict the appearance of the site during each of the surveys.



Figure 5.7 Photograph of Sweetwater Creek Site SW003 taken on May 26, 2013, the upstream view of the 150-m transect.



Figure 5.8 Photograph of Sweetwater Creek Site SW003 taken on July 29, 2013, the upstream view of the 300-m transect.

Site SW003 was wadeable for the entire 300-m reach length. Average thalweg ranged from 0.28 m during the first survey to 0.11 m during the second survey when the stream was significantly lower (Table 5.6). During both surveys, the shallow water depths and sandy substrate made wading in the stream channel easy. Tree obstructions were encountered at various locations throughout the reach which would make tubing or canoeing difficult. Widths of the stream ranged from maximum of 11 m the first survey to a minimum of 0.65 m during the second survey (Tables 5.7 and 5.8).

Aesthetic appearance of the water and wildlife observations for the site during each survey have been previously provided in Tables 5.9 and 5.10, respectively. There were no mammals or vertebrates observed during either survey. Tracks observed during each trip consisted of cattle, deer, raccoon, canine, and bird. Cattle and bird feces were also found throughout the reach. Aquatic vegetation was rare during both surveys, while algae was common during the first survey and absent during the second survey. The water color was green during the first survey with no surface scum or foam. During the second survey the water color varied from brown to black. Trash observed was rare throughout the reach and consisted of typical plastic cups and bottles. Evidence of human presence found within the reach was a fishing bobber hung in a tree and all terrain vehicle (ATV) tracks, both found just below the 150-m transect. The fishing bobber appeared to have been washed in from upstream. Additionally, a large water pump with black pipes stretching to the stream was on the bank upstream of the road crossing, 150-m transect (Figure 5.7). A large intake pipe was also encountered in the stream just below the road crossing. These pipes and pump are believed to be associated with one of the drilling operations in the area.

Physical Description of SW004

Sweetwater Creek at site SW004 was visited on May 26 and July 29, 2013. This site, located east of Wheeler, Texas in Wheeler County, was accessible only through private lands that were fenced with a cattle guard and potentially locked gate. With landowner permission, TIAER personnel entered private property over the cattle guard and drove approximately 450 yards on a pasture road past an old shale pit to reach the site. During the second survey, there were oil field persons working on a drill rig and pad just inside the property fence. TIAER personnel had to drive around all of the vehicles using a different route to reach the site. The site is located in a shrub dominated corridor (Table 5.5). At the site, access to the stream was moderately difficult due to the steep banks located on alternating banks throughout the reach (Table 5.6). Figures 5.9 and 5.10 depict the appearance of the site during each of the surveys.



Figure 5.9 Photograph of Sweetwater Creek Site SW004 taken on May 26, 2013, the upstream view of the 30-m transect. TIAER vehicle shown in the background.



Figure 5.10 Photograph of Sweetwater Creek Site SW004 taken on July 29, 2013, the upstream view of the 300-m transect.

Site SW004 was wadeable for the entire 300-m reach length. Average thalweg ranged from 0.28 m during the first survey to 0.0 m during the second survey when the stream was dry (Table 5.6). During both surveys, the shallow water depths or lack of water with the sandy substrate made wading in the stream channel easy. Widths of the stream ranged from 3.0 m to 6.4 m during the first survey when water was present (Tables 5.7 and 5.8). One log jam was encountered during the second survey while overhanging trees were encountered during both surveys that posed as obstructions.

Aesthetic appearance of the water and wildlife observations for the site during each survey have been previously provided in Tables 5.9 and 5.10, respectively. There was a moderate presence of cattle during the first survey and a slight presence during the second survey. No other mammals or vertebrates were observed during either survey. Tracks observed during each trip consisted of cattle, deer, and horse. Cattle and bird feces were found throughout the reach. Aquatic vegetation was common during both surveys while algae was common during the first survey and absent during the second survey due to the lack of any water. The water color during the first survey was clear with no surface scum or foam. Trash was rarely observed throughout the reach and when encountered, consisted of typical plastic cups and bottles with an occasional feed sack. No evidence of human presence was found within the reach.

Physical Description of SW005

Sweetwater Creek at site SW005 was visited on May 26 and July 29, 2013. This site, located east of Wheeler, Texas in Wheeler County, was accessible only through private lands that were fenced with a cattle guard and potentially locked gate. With landowner permission, TIAER personnel entered private property over the cattle guard and drove approximately one-half mile on a pasture road to reach the site. The site is located in a shrub dominated corridor (Table 5.5). At the site, access to the stream was moderately easy (Table 5.6). Figures 5.11 and 5.12 depict the appearance of the site during each of the surveys.

Site SW005 was wadeable for the entire 300-m reach length. Average thalweg ranged from 0.31 m during the first survey to 0.0 m during the second survey when the stream was dry (Table 5.6). During both surveys, the shallow water depths or lack of water with the sandy substrate made wading in the stream channel easy. Widths of the stream ranged from 2.5 m to 10 m during the first survey when water was present (Tables 5.7 and 5.8). There were a couple of log obstructions and one metal water gap located in the lower half of the reach (Figure 5.13).

Aesthetic appearance of the water and wildlife observations for the site during each survey have been previously provided in Tables 5.9 and 5.10, respectively. There were no mammals or vertebrates observed during either survey. Tracks observed during each trip consisted of cattle, deer, raccoon and turkey. Cattle and bird feces were also found throughout the reach. Aquatic vegetation was common during both surveys while algae was common during the first survey and absent during the second survey due to the lack of water. The water color was clear during the first survey with no surface scum or foam. Trash was rarely observed throughout the reach and when encountered, consisted of typical plastic cups and bottles with one observance of a plastic 55-gallon drum. No evidence of recreation was observed within the reach.



Figure 5.11 Photograph of Sweetwater Creek Site SW005 taken on May 26, 2013, the downstream view of the 300-m transect.



Figure 5.12 Photograph of Sweetwater Creek Site SW005 taken on July 29, 2013, the upstream view of the 150-m transect.



Figure 5.13 Photograph of Sweetwater Creek Site SW005 taken on May 26, 2013, the water gap obstruction.

Physical Description of SW006

Sweetwater Creek at site SW006 was visited on May 26 and July 29, 2013. This site, located east of Wheeler, Texas in Wheeler County, was accessible only through private lands that were fenced with a cattle guard and potentially locked gate. With landowner permission, TIAER personnel entered private property over the cattle guard and drove approximately one mile on a gravel road to reach the site. The site is located in a shrub dominated corridor for the lower half of the reach and a pasture dominated corridor for the upper half (Table 5.5). At the site, access to the stream was moderately easy (Table 5.6). At other locations throughout the reach, access to the stream was more challenging due to steep banks and dense vegetation. Figures 5.14 and 5.15 depict the appearance of the site during each of the surveys.

Site SW006 was wadeable for the entire 300-m reach length. Average thalweg ranged from 0.29 m during the first survey to 0.0 m during the second survey when the stream was dry (Table 5.6). During both surveys, the shallow water depths or lack of water with the sandy substrate made wading in the stream channel easy. Widths of the stream ranged from 3.5 m to 11 m during the first survey when water was present (Tables 5.7 and 5.8). There were debris pile obstructions and some overhanging trees during both surveys which made traversing the streambed sometimes challenging.



Figure 5.14 Photograph of Sweetwater Creek Site SW006 taken on May 26, 2013, the upstream view of the 150-m transect.



Figure 5.15 Photograph of Sweetwater Creek Site SW006 taken on July 29, 2013, the upstream view of the 30-m transect.

Aesthetic appearance of the water and wildlife observations for the site during each survey have been previously provided in Tables 5.9 and 5.10, respectively. There was a slight presence of cattle during both surveys and a porcupine was encountered during the second survey. No other mammals or vertebrates were observed during either survey. Tracks observed during each trip consisted of cattle, deer, raccoon, and feline. Cattle, deer, and bird feces were also found throughout the reach during both surveys. Aquatic vegetation was rare during both surveys while algae was rare during the first survey and absent during the second survey due to the lack of any water. The water color varied from green to brown during the first survey with no surface scum or foam. Trash was rarely observed throughout the reach and when encountered, consisted of typical plastics and aluminum cans with an occasional feed sack. Various pieces of sheet metal were also observed. No evidence of recreational activity was found within the reach.

Physical Description of SW007

Sweetwater Creek at site SW007 was visited on May 26 and July 29, 2013. This site, located east of Wheeler, Texas in Wheeler County, was accessible only through private lands that were fenced with a cattle guard and potentially locked gate. With landowner permission, TIAER personnel entered private property over the cattle guard and drove approximately 1.5 miles on a gravel road through additional interior gates to reach the site. The site is located in a shrub dominated corridor for the entire length of the reach (Table 5.5). At the site, access to the stream was moderately difficult (Table 5.6). TIAER personnel were selective in choosing an entrance to the stream due to the dense stands of trees, high banks, and a water gap fence at the lower end of the reach. Figures 5.16 and 5.17 depict the appearance of the site during each of the surveys.



Figure 5.16 Photograph of Sweetwater Creek Site SW007 taken on May 26, 2013, the upstream view of the 300-m transect. TIAER personnel in photograph.



Figure 5.17 Photograph of Sweetwater Creek Site SW007 taken on July 29, 2013, the upstream view of the 30-m transect.

Site SW007 was wadeable for the entire 300-m reach length. Average thalweg ranged from 0.28 m during the first survey to 0.12 m during the second survey when the stream was significantly lower (Table 5.6). During both surveys, the shallow water depths with the sandy substrate made wading in the stream channel easy. Widths of the stream ranged from a minimum of 0.4 m during the second survey to a maximum of 7.0 m during the first survey (Tables 5.7 and 5.8). There were several tree obstructions and some overhanging trees during both surveys which made traversing the streambed sometimes challenging (Figure 5.18).

Aesthetic appearance of the water and wildlife observations for the site during each survey have been previously provided in Tables 5.9 and 5.10, respectively. During the first survey, there was a slight presence of deer with no other mammals or vertebrates encountered. During the second survey, there was a slight presence of snakes and a moderate presence of cattle with no other vertebrates or mammals observed. Tracks observed during each trip consisted of cattle, deer, raccoon, bird, and canine. Cattle, deer, canine, and bird feces were also found throughout the reach during both surveys. Aquatic vegetation was rare to common between the first and second survey, respectively. Algae was common to absent from the first survey to the second survey. The water color was clear during both surveys with no surface scum or foam. Trash of any kind was absent during both surveys. No evidence of human presence was found within the reach.



Figure 5.18 Photograph of typical obstructions at Sweetwater Creek Site SW007 taken on July 29, 2013.

Physical Description of SW008

Sweetwater Creek at site SW008 was visited on May 26 and July 29, 2013. This site, located east of Wheeler, Texas in Wheeler County, was accessible only through private lands that were fenced with a cattle guard and potentially locked gate. With landowner permission, TIAER personnel entered private property over the cattle guard and drove approximately 0.75 mile on a gravel oilfield road to reach the site. The site is located in a shrub dominated corridor with trees along each stream bank and pasture land beyond (Table 5.5). At the site, access to the stream was moderately easy (Table 5.6). At other locations throughout the reach, access to the stream was more challenging due to steep banks, tree obstructions and dense vegetation. Figures 5.19 and 5.20 depict the appearance of the site during each of the surveys.

Site SW008 was wadeable for the entire 300-m reach length. Average thalweg ranged from 0.27 m during the first survey to 0.06 m during the second survey when the stream was significantly lower (Table 5.6). During both surveys, the shallow water depths with the sandy substrate made wading in the stream channel easy. Widths of the stream ranged from a maximum of 9.0 m during the first survey to a minimum of 0.46 m during the second survey (Tables 5.7 and 5.8). Log obstructions and overhanging trees were encountered during both surveys which made traversing the streambed sometimes challenging.



Figure 5.19 Photograph of Sweetwater Creek Site SW008 taken on May 26, 2013, the downstream view of the 300-m transect.



Figure 5.20 Photograph of Sweetwater Creek Site SW008 taken on July 29, 2013, the upstream view of the 150-m transect.

Aesthetic appearance of the water and wildlife observations for the site during each survey have been previously provided in Tables 5.9 and 5.10, respectively. No vertebrates or mammals were observed during the first survey. During the second survey, there was a slight presence of snakes and wildlife, a porcupine, with no other animals observed. Tracks observed during each trip consisted of cattle, deer, raccoon, porcupine, and turkey. Cattle, deer, raccoon, porcupine, and bird feces were found throughout the reach during both surveys. Additionally, gnaw marks were observed on several trees along the banks during both surveys (Figure 5.21). Aquatic vegetation was common during the first survey and rare during the second survey, while algae was rare during both surveys. The water color was clear with no surface scum or foam during both surveys. Trash was rarely observed throughout the reach and when encountered, consisted of typical plastics and aluminum cans. No evidence of human recreational activity was observed within the reach.



Figure 5.21 Photograph of Sweetwater Creek Site SW008 taken on July 29, 2013 showing typical gnaw marks observed on several trees within the survey reach.

Physical Description of SW009

Sweetwater Creek at site SW009 was visited on May 26 and July 28, 2013. This site, located east of Wheeler, Texas in Wheeler County, was accessible only through private lands that were fenced and required landowner cooperation to enter the property. With landowner permission, TIAER personnel drove underneath the Ranch Road 592 bridge crossing and crossed a private property fence to conduct the entire 300 meter length of the reach. Although this site is listed as being publicly accessible, it is only accessible to the public for approximately 20 meter upstream and downstream of the bridge. Water gaps cross the stream impeding persons from traversing the stream in both directions (Figure 5.22).



Figure 5.22 Photograph of Sweetwater Creek Site SW009 taken on July 28, 2013 showing the water gap downstream of the bridge.

The site is located in a tree dominated corridor on the left bank and a pasture dominated corridor on the right bank (Table 5.5). At the site, access to the stream was moderately difficult due to steep banks, dense vegetation and tree obstructions (Table 5.6). Figures 5.23 and 5.24 depict the appearance of the site during each of the surveys.

Site SW009 was wadeable for the entire 300-m reach length. Average thalweg ranged from 0.39 m during the first survey to 0.24 m during the second survey when the stream was significantly lower (Table 5.6). During both surveys, the mud/clay channel bottom and sometimes dense aquatic vegetation made wading in the stream challenging. Small pockets of sludge were also encountered which were potentially hazardous. Widths of the stream ranged from a maximum of 6.5 m during the first survey to a minimum of 0.90 m during the second survey (Tables 5.7 and 5.8). Log obstructions and overhanging trees were encountered during both surveys which made traversing the streambed sometimes challenging. One beaver dam was observed near the 150-m transect.

Aesthetic appearance of the water and wildlife observations for the site during each survey have been previously provided in Tables 5.9 and 5.10, respectively. One raccoon was observed during the first survey with no other sighting of vertebrates or mammals. During the second survey, there was a slight presence of snakes and wildlife, rabbits and deer, with no other animals observed. Tracks observed during each trip consisted of deer and raccoon. Deer and bird feces were found throughout the reach during both surveys.



Figure 5.23 Photograph of Sweetwater Creek Site SW009 taken on May 26, 2013, the downstream view of the 30-m transect.



Figure 5.24 Photograph of Sweetwater Creek Site SW009 taken on July 28, 2013, the upstream view of the 300-m transect.

Aquatic vegetation was abundant during both surveys, while algae was common during the first survey and rare during the second. Water color was brown during the first survey and clear during the second. Small areas of surface scum and foam were observed during both surveys. Trash was common, particularly in the area underneath the bridge consisting of buckets, pallets, cinder blocks, assorted bottles, and typical plastics. In the areas of the reach on private property, trash was rarely observed and when encountered, consisted of typical plastics and aluminum cans. The only evidence of human activity was in the form of many beer bottles underneath the bridge at the 300-m transect. No other evidence of human activity was observed throughout the rest of the reach.

Physical Description of SW010

Sweetwater Creek at site SW010 was visited on May 27 and July 29, 2013. This site, located east of Wheeler, Texas in Wheeler County, was accessible only through private lands that were fenced with a cattle guard and potentially locked gate. With landowner permission, TIAER personnel entered private property over the cattle guard and drove approximately 0.75 mile on a gravel oilfield road, through an additional gate, and then along a pasture road to reach the site. The site is located in a shrub dominated corridor with trees along each stream bank and pasture land beyond (Table 5.5). At the site, access to the stream was moderately difficult due to dense vegetation and steep, easily erodible banks (Table 5.6). Figures 5.25 and 5.26 depict the appearance of the site during each of the surveys.



Figure 5.25 Photograph of Sweetwater Creek Site SW010 taken on May 27, 2013, the upstream view of the 30-m transect.



Figure 5.26 Photograph of Sweetwater Creek Site SW010 taken on July 29, 2013, the downstream view of the 150-m transect.

Site SW010 was wadeable for the entire 300-m reach length. Average thalweg ranged from 0.28 m during the first survey to 0.10 m during the second survey when the stream was significantly lower (Table 5.6). During both surveys, the shallow water depths with primarily sandy substrate made wading in the stream channel easy. Widths of the stream ranged from a maximum of 4.2 m during the first survey to a minimum of 0.6 m during the second survey (Tables 5.7 and 5.8). Log obstructions and overhanging trees encountered during both surveys made traversing the streambed sometimes difficult.

Aesthetic appearance of the water and wildlife observations for the site during each survey have been previously provided in Tables 5.9 and 5.10, respectively. There was a slight presence of snakes and a moderate presence of cattle with no other animals or vertebrates during the first survey. During the second survey, there was a slight presence of snakes and wildlife with no other animals observed. Tracks observed during each trip consisted of cattle, deer, raccoon, and turkey. Various animal feces were found throughout the reach during both surveys. Aquatic vegetation was common during the first survey and rare during the second survey, while algae was abundant during the first survey and rare during the second survey. Water color was clear with only one small occurrence of surface scum observed during the first survey. Trash was rarely observed throughout the reach and when encountered, consisted of typical plastics. No evidence of human recreational activity was observed within the reach.

Physical Description of SW011

Sweetwater Creek at site SW011 was visited on May 27 and July 29, 2013. This site, located east of Wheeler, Texas in Wheeler County, was accessible only through private lands that were fenced with a cattle guard and potentially locked gate. With landowner permission, TIAER personnel entered private property over the cattle guard with a gate and drove approximately 700 feet through a cultivated field right-of-way to reach the site. The site is located in a shrub dominated corridor with trees along each stream bank and pasture land beyond (Table 5.5). At the site, access to the stream was moderately difficult due to dense vegetation and steep banks (Table 5.6). Figures 5.27 and 5.28 depict the appearance of the site during each of the surveys.



Figure 5.27 Photograph of Sweetwater Creek Site SW011 taken on May 26, 2013, the upstream view of the 300-m transect. TIAER vehicle in background.

Site SW011 was wadeable for the entire 300-m reach length. Average thalweg ranged from 0.26 m during the first survey to 0.09 m during the second survey when the stream was significantly lower (Table 5.6). During both surveys, the shallow water depths with primarily sandy substrate made wading in the stream channel easy for most of the reach. Widths of the stream ranged from a maximum of 4.0 m during the first survey to a minimum of 0.0 m during the second survey (Tables 5.7 and 5.8). Log obstructions, overhanging trees and dense aquatic vegetation encountered during both surveys made traversing the streambed sometimes challenging.



Figure 5.28 Photograph of Sweetwater Creek Site SW011 taken on July 29, 2013, the downstream view of the 150-m transect.

Aesthetic appearance of the water and wildlife observations for the site during each survey have been previously provided in Tables 5.9 and 5.10, respectively. There was a slight presence of wildlife, a raccoon, with no other animals or vertebrates during the first survey. During the second survey, there was a slight presence of snakes and wildlife. Tracks observed during each trip consisted of deer, raccoon, and bird. Bird feces were found throughout the reach during both surveys. A dead deer was observed during the first survey near the 0-m transect.

Aquatic vegetation was common during both surveys, while algae was common during the first survey and absent during the second survey. Water color was clear and green during the first survey and clear during the second survey with no surface scum or foam observed during either survey. Trash was rarely observed throughout the reach and when encountered, consisted of typical plastics, aluminum cans, bottles, tires and pieces of lumber. The only evidence of recreational activity was observed during the second survey in the form of two minnow traps found near the 120-m transect as shown in Figure 5.29. Ropes were attached to each trap and ran up the steep bank. Conversations with the landowner revealed that the son of the landowner use these traps with the intention of fishing at one of the tanks on the property.



Figure 5.29 Photograph of Sweetwater Creek Site SW011 taken on July 29, 2013 showing two minnow traps in the stream near the 120-m transect.

Physical Description of SW012

Sweetwater Creek at site SW012 was visited on May 27 and July 29, 2013. This site, located east of Wheeler, Texas in Wheeler County, was accessible only through private lands that were fenced with a cattle guard and potentially locked gate. With landowner permission, TIAER personnel entered private property over the cattle guard and drove approximately one-half mile down a gravel road and parked at the landowner's barn. TIAER personnel then walked over a fence through a pasture approximately 250 feet to reach the site. During the first survey, a security guard, hired by the landowner to monitor the new oil well being drilled, stopped and questioned us before allowing us access to the road leading to the barn. The site is located in a shrub dominated corridor with trees along each stream bank and pasture land beyond (Table 5.5). At the site, access to the stream was moderately easy (Table 5.6). Figures 5.30 and 5.31 depict the appearance of the site during each of the surveys.



Figure 5.30 Photograph of Sweetwater Creek Site SW012 taken on May 27, 2013, the upstream view of the 300-m transect.



Figure 5.31 Photograph of Sweetwater Creek Site SW012 taken on July 29, 2013, the upstream view of the 300-m transect.

Site SW012 was wadeable for the entire 300-m reach length. Average thalweg ranged from 0.31 m during the first survey to 0.04 m during the second survey when the stream was significantly lower (Table 5.6). During both surveys, the shallow water depths with primarily sandy substrate made wading in the stream channel easy for most of the reach. Widths of the stream ranged from a maximum of 5.7 m during the first survey to a minimum of 0.0 m during the second survey when only pockets of water were encountered (Tables 5.7 and 5.8). A couple of log obstructions were encountered during both surveys.

Aesthetic appearance of the water and wildlife observations for the site during each survey have been previously provided in Tables 5.9 and 5.10, respectively. There was a slight presence of snakes and deer during the first survey with no other animals or vertebrates encountered. During the second survey, there were no observations of any mammals or vertebrates. Tracks observed during each trip consisted of cattle, deer, raccoon, feline, and bird. Bird and cattle feces were found throughout the reach during both surveys. Aquatic vegetation was common during both surveys, while algae was abundant during the first survey and rare during the second survey. Water color was clear during both surveys with no surface scum or foam. No trash of any kind was observed within the reach during either survey. No evidence of human activity in the creek was encountered during the either survey.

Physical Description of SW013

Sweetwater Creek at site SW013 was visited on May 26 and July 28, 2013. This site, located east of Wheeler, Texas in Wheeler County, was accessible only through private lands that were fenced with a cattle guard and potentially locked gate. With landowner permission, TIAER personnel entered private property over the cattle guard and drove approximately three-quarter mile down a gravel road around a gravel oil drilling pad and through the pasture to reach the site. There was no activity at the drill pad during the first survey, but drilling had commenced during the second survey. The site is located in a grass dominated corridor with shrubs and a few trees along each stream bank (Table 5.5). At the site, access to the stream was moderately difficult due to steep banks, vegetation, and large tree obstructions (Table 5.6). Figures 5.32 and 5.33 depict the appearance of the site during each of the surveys.



Figure 5.32 Photograph of Sweetwater Creek Site SW013 taken on May 26, 2013, the upstream view of the 150-m transect.



Figure 5.33 Photograph of Sweetwater Creek Site SW013 taken on July 28, 2013, the upstream view of the 300-m transect.

Site SW013 was wadeable for the entire 300-m reach length. Average thalweg ranged from 0.35 m during the first survey to 0.08 m during the second survey when the stream was significantly lower (Table 5.6). During both surveys, the shallow water depths with the primarily sandy substrate made wading in the stream channel easy for most of the reach. Widths of the stream ranged from a maximum of 6.0 m during the first survey to a minimum of 0.4 m during the second survey when the stream was significantly lower (Tables 5.7 and 5.8). Tree obstructions and overhanging branches were encountered during both surveys, which made traversing the stream sometimes challenging.

Aesthetic appearance of the water and wildlife observations for the site during each survey have been previously provided in Tables 5.9 and 5.10, respectively. There was a slight presence of snakes and water dependent birds during the first survey with no other animals or vertebrates encountered. During the second survey, there were no observations of any mammals or vertebrates. Evidence of beaver activity was identified in the form of several trees with gnaw marks throughout the reach. Tracks observed during each trip consisted of cattle, deer, and raccoon. Bird, raccoon, and cattle feces were found throughout the reach during both surveys. Aquatic vegetation was abundant during the first survey and common during the second survey. Algae was abundant during the first survey and rare during the second survey. Water color was clear during both surveys with only one area of surface scum or foam encountered during the second survey. No trash of any kind was observed within the reach during either survey. Evidence of human activity was not observed during the either survey.

Physical Description of SW014

Sweetwater Creek at site SW014 was visited on May 26 and July 28, 2013. This site, located northeast of Wheeler, Texas in Wheeler County, was accessible only through private lands that were fenced with a cattle guard and potentially locked gate. With landowner permission, TIAER personnel entered private property over the cattle guard and drove approximately one-half mile down a gravel road and through the pasture to reach the site. The site is located in a shrub dominated corridor with trees along the stream bank (Table 5.5). At the site, access to the stream was moderately easy with low banks and shallow water depths (Table 5.6). Figures 5.34 and 5.35 depict the appearance of the site during each of the surveys.

Site SW014 was wadeable for the entire 300-m reach length. Average thalweg ranged from 0.20 m during the first survey to 0.0 m during the second survey when only a few puddles of water were encountered (Table 5.6). During both surveys, the primarily sandy substrate and shallow to nonexistent water depths made wading in the stream channel easy. Widths of the stream ranged from a maximum of 4.8 m during the first survey to a minimum of 0.0 m during the second survey when the stream was dry (Tables 5.7 and 5.8). The only obstruction encountered during both surveys was a barbed wire fence, which stretched across the stream and served as a water gap.



Figure 5.34 Photograph of Sweetwater Creek Site SW014 taken on May 26, 2013, the downstream view of the 150-m transect.



Figure 5.35 Photograph of Sweetwater Creek Site SW014 taken on July 28, 2013, the upstream view of the 300-m transect.

Aesthetic appearance of the water and wildlife observations for the site during each survey have been previously provided in Tables 5.9 and 5.10, respectively. There was no observance of any mammals or vertebrates during either survey. Tracks observed during each trip consisted of cattle, beaver, and raccoon. Bird and cattle feces were found throughout the reach during both surveys. One bird nest which had fallen into the stream was observed during the second survey. Aquatic vegetation was common during the first survey and rare during the second survey. Algae was common during the first survey and absent during the second survey when the stream was dry. Water color was clear during first survey with no surface scum or foam encountered. Bank garbage was encountered during the first survey in the form of baling twine and a piece of lumber. No other trash of any kind was observed within the reach during either survey. There was no evidence of human activity found during the either survey.

Physical Description of SW015

Sweetwater Creek at site SW015 was visited on May 26 and July 28, 2013. This site, located northeast of Wheeler, Texas in Wheeler County, was accessible only through private land that was fenced. Although the site is listed as being publicly accessible, property fences to the edge of the bridge crossing limit accessibility. With landowner permission, TIAER personnel entered private property over the fence to gain stream access at the site. The site is located in a grass and forbs dominated corridor with trees along the stream bank (Table 5.5). At the site, access to the stream was easy with low banks and shallow water depths (Table 5.6). Figures 5.36 and 5.37 depict the appearance of the site during each of the surveys.



Figure 5.36 Photograph of Sweetwater Creek Site SW015 taken on May 26, 2013, the upstream view of the 30-m transect. TIAER personnel in photograph.



Figure 5.37 Photograph of Sweetwater Creek Site SW015 taken on July 28, 2013, the upstream view of the 150-m transect.

Site SW015 was wadeable for only 290 m of the 300-m reach length. A barbed wire property boundary fence located at the 10-m transect prevented TIAER personnel from completing the entire 300-m length of the reach (Figure 5.38). Average thalweg ranged from 0.18 m during the first survey to 0.11 m during the second survey (Table 5.6). During both surveys, the sandy substrate and shallow water depths made wading in the stream channel easy. Widths of the stream ranged from a maximum of 3.7 m during the first survey to a minimum of 1.0 m during the second survey (Tables 5.7 and 5.8). Other than the barbed wire fence obstruction, the only other obstructions were tree obstructions encountered during both surveys.

Aesthetic appearance of the water and wildlife observations for the site during each survey have been previously provided in Tables 5.9 and 5.10, respectively. During the first survey, there was a slight presence of snakes with no other mammals or vertebrates observed. There was no observance of any animals during the second survey. Tracks observed during each trip consisted of cattle, deer, and turkey. Bird and cattle feces were found throughout the reach during both surveys. Aquatic vegetation was common during both surveys, while algae was common during the first survey and rare during the second survey. Water color was clear during both surveys with only one small area of surface scum encountered during the first survey. Trash, which was rarely observed only during the first survey, consisted of typical plastics and aluminum cans. There was no evidence of human recreational activity found during the either survey.



Figure 5.38 Photograph of Sweetwater Creek Site SW015 taken on May 26, 2013, the barbed wire fence at the 10-m transect.

Physical Description of SW016

Sweetwater Creek at site SW016 was visited on May 27 and July 28, 2013. This site, located northeast of Wheeler, Texas in Wheeler County, was accessible only through private land that was fenced. Although the site is listed as being publicly accessible, property fences close to the culvert road crossing limit accessibility to approximately two meters upstream and downstream of the culvert. With dense vegetation in the bar ditch of the road, this site, for all practical purposes, is not publicly accessible (Figure 5.39). With landowner permission, TIAER personnel entered private property over the fence to gain stream access at the site. The site is located in a grass dominated corridor with trees along the stream bank (Table 5.5). At the site, access to the stream was easy with low banks and shallow water depths (Table 5.6). Figures 5.40 and 5.41 depict the appearance of the site during each of the surveys.

Site SW016 was wadeable for the entire 300-m reach length. Average thalweg ranged from 0.20 m during the first survey to 0.0 m during the second survey when the stream was dry (Table 5.6). During both surveys, the sandy substrate and shallow to non-existent water depths made wading in the stream channel easy. Widths of the stream ranged from a maximum of 3.6 m during the first survey to a minimum of 0.0 m during the second survey when no water was present (Tables 5.7 and 5.8). The only obstructions encountered were the barbed wire property fence and the concrete culvert; both located just below the 0-m transect (Figure 5.42).



Figure 5.39 Photograph of Sweetwater Creek Site SW016 taken on July 28, 2013 showing public accessibility to the stream.



Figure 5.40 Photograph of Sweetwater Creek Site SW016 taken on May 27, 2013, the downstream view of the 150-m transect.



Figure 5.41 Photograph of Sweetwater Creek Site SW016 taken on July 28, 2013, the upstream view of the 150-m transect. TIAER personnel in the photograph.



Figure 5.42 Photograph of Sweetwater Creek Site SW016 taken on May 27, 2013 showing the concrete culvert and property fence.

Aesthetic appearance of the water and wildlife observations for the site during each survey have been previously provided in Tables 5.9 and 5.10, respectively. The only animal observed during the first survey was a turtle. During the second survey, there was a moderate presence of deer and a slight presence of cattle with no other mammals or vertebrates observed. Tracks observed during each trip consisted of cattle, deer, and raccoon. Bird and cattle feces were found throughout the reach during both surveys. Aquatic vegetation was rare during both surveys, while algae was abundant during the first survey and absent during the second survey due to a lack of water. Water color was clear with no surface scum encountered during the first survey. The only trash observed was one tire located at the concrete culvert, which was just outside of the survey reach. No other trash was observed during either survey. There was no evidence of human recreational activity found by TIAER personnel.

Physical Description of SW017

Sweetwater Creek at site SW017 was visited on May 27 and July 29, 2013. This site, located northeast of Wheeler, Texas in Wheeler County, was accessible only through private land that was fenced and required landowner permission to access. With landowner permission, TIAER personnel drove approximately three-quarter mile down a private drive to reach the landowners house. From the house, TIAER personnel utilized the landowner's 4-wheel drive vehicle, with the landowner serving as chauffeur, to drive approximately one mile across cultivated and pasture land through additional interior gates to reach the site. During the second trip, the 4-wheel drive vehicle was not available and personnel had to use an alternate route to reach the site, which required walking approximately one-half mile west of County Road 17. The property crossed to reach the site was being leased by the landowner of the site, so additional landowner permission was not required.

The site is located in a shrub dominated corridor with trees along the stream bank and pasture land beyond (Table 5.5). At the site, access to the stream was moderately easy depending on the entry point to the stream. Some of the banks were low while others were of moderate height with exposed tree roots along the banks (Table 5.6). Figures 5.43 and 5.44 depict the appearance of the site during each of the surveys.

Site SW017 was wadeable for the entire 300-m reach length. Average thalweg ranged from 0.13 m during the first survey to 0.0 m during the second survey when the stream was dry (Table 5.6). During both surveys, the sandy substrate and shallow to non-existent water depths made wading in the stream channel easy. Widths of the stream ranged from a maximum of 4.8 m during the first survey to a minimum of 0.0 m during the second survey when no water was present (Tables 5.7 and 5.8). The only obstructions encountered were the barbed wire property fence (Figure 5.44) and small log jam, both located near the 150-m transect.



Figure 5.43 Photograph of Sweetwater Creek Site SW017 taken on May 27, 2013, the upstream view of the 300-m transect.



Figure 5.44 Photograph of Sweetwater Creek Site SW017 taken on July 29, 2013, the downstream view of the 150-m transect.

Aesthetic appearance of the water and wildlife observations for the site during each survey have been previously provided in Tables 5.9 and 5.10, respectively. There was a slight presence of deer during the first survey with no other animals observed. During the second survey, there was a moderate presence of deer with no other mammals or vertebrates observed. Tracks observed during each trip consisted of cattle and deer. Bird, horse, and cattle feces were found throughout the reach during both surveys. Aquatic vegetation and algae were both rarely observed during the first survey and absent during the second survey due to the lack of water. During the first survey, water color was clear with no surface scum encountered. The only trash observed was one bottle observed during the second survey. No other trash was observed during either survey. No evidence of human recreational activity was observed.

Physical Description of SW018

Sweetwater Creek at site SW018 was visited on May 27 and July 29, 2013. This site, located north of Wheeler, Texas in Wheeler County, was accessible only through private land that was fenced and required landowner permission to access. With landowner permission, TIAER personnel drove approximately three-quarter mile down a private drive to reach the landowners house. The site is located approximately 250 feet north of the landowner's house (Figure 5.45). The site is located in a grass and forbs dominated corridor with trees along the stream bank and pasture land beyond (Table 5.5). At the site, access to the stream was moderately easy depending on the entry point to the stream. Some of the banks were low while others were of moderate height with dense vegetation along the banks (Table 5.6). Figures 5.45 and 5.46 depict the appearance of the site during each of the surveys.



Figure 5.45 Photograph of Sweetwater Creek Site SW018 taken on May 27, 2013, the upstream view of the 300-m transect. Landowner's house in background.



Figure 5.46 Photograph of Sweetwater Creek Site SW018 taken on July 29, 2013, the downstream view of the 30-m transect.

Site SW018 was wadeable for the entire 300-m reach length. Average thalweg ranged from 0.21 m during the first survey to 0.0 m during the second survey when the stream was dry (Table 5.6). During both surveys, the sandy substrate and shallow to non-existent water depths made wading in the stream channel easy. Widths of the stream ranged from a maximum of 5.2 m during the first survey to a minimum of 0.0 m during the second survey when no water was present (Tables 5.7 and 5.8). The only obstructions encountered were a barbed wire fence and a few log jams throughout the reach.

Aesthetic appearance of the water and wildlife observations for the site during each survey have been previously provided in Tables 5.9 and 5.10, respectively. There was no observance of any mammals or vertebrates during either of the surveys. Tracks observed during each trip consisted of cattle and deer. Bird and cattle feces were found throughout the reach during both surveys. Aquatic vegetation was common during the first survey and rare during the second survey. Algae was abundant during the first survey and absent during the second survey due to the lack of water. During the first survey, water color was clear with no surface scum encountered. The only trash observed was one tractor tire observed during the second survey. No other trash was observed during either survey. No evidence of human recreational activity was observed during either survey.

Physical Description of SW019

Sweetwater Creek at site SW019 was visited on May 27 and July 29, 2013. This site, located north of Wheeler, Texas in Wheeler County, was accessible only through private land that was fenced

and required landowner permission to access. With landowner permission, TIAER personnel drove approximately three-quarter mile down a private drive to reach the landowners house. As with Site SW017, TIAER personnel utilized the landowner's 4-wheel drive vehicle, from the house with the landowner serving as chauffeur, to drive approximately one mile across cultivated and pasture land through additional interior gates to reach the site. During the second trip, the 4-wheel drive vehicle was not available and personnel had to use an alternate route to reach the site, which required walking approximately one-half mile north of the intersection of County Road 5 and County Road I.

The site is located in a grass and forb dominated corridor with trees along the stream bank and pasture land beyond (Table 5.5). At the site, access to the stream was moderately easy depending on the entry point to the stream. Some of the banks were low while others were of moderate height with dense vegetation along the banks (Table 5.6). Figures 5.47 and 5.48 depict the appearance of the site during each of the surveys.



Figure 5.47 Photograph of Sweetwater Creek Site SW019 taken on May 27, 2013, the downstream view of the 30-m transect.



Figure 5.48 Photograph of Sweetwater Creek Site SW019 taken on July 29, 2013, the downstream view of the 300-m transect.

Site SW019 was wadeable for the entire 300-m reach length. Average thalweg ranged from 0.19 m during the first survey to 0.0 m during the second survey when the stream was dry (Table 5.6). During both surveys, the sandy substrate and shallow to non-existent water depths made wading in the stream channel easy. Widths of the stream ranged from a maximum of 4.1 m during the first survey to a minimum of 0.0 m during the second survey when no water was present (Tables 5.7 and 5.8). The only obstruction encountered was periodic thick vegetation encountered during the second survey.

Aesthetic appearance of the water and wildlife observations for the site during each survey have been previously provided in Tables 5.9 and 5.10, respectively. There was no observance of any mammals or vertebrates during either of the surveys. Deer tracks were observed during both surveys. Bird and deer feces were found throughout the reach during both surveys. Aquatic vegetation was common during the first survey and rare during the second survey. Algae was absent during both surveys. When water was present, water color was clear with no surface scum encountered. No trash or evidence of human activity was observed during either survey.

Physical Description of SW020

Sweetwater Creek at site SW020 was visited on May 27 and July 29, 2013. This site, located north of Wheeler, Texas in Wheeler County, was accessible through private land that was fenced and required landowner permission to access. Although the site is listed as being publicly accessible, access is limited to approximately 20 meters upstream and downstream of the bridge crossing on State Highway 83 due to a barbed wire fence (Figure 5.49). With permission from the landowner,

TIAER personnel drove through a gate on the southwest side of the bridge crossing to reach the site. The site is located in a grass and forb dominated corridor with trees along the stream bank and pasture land beyond (Table 5.5). At the site, access to the stream was moderately easy depending on the entry point to the stream. Some of the banks were low while others were of moderate height with dense vegetation along the banks (Table 5.6). Figures 5.49 and 5.50 depict the appearance of the site during each of the surveys.



Figure 5.49 Photograph of Sweetwater Creek Site SW020 taken on May 27, 2013, the downstream view of the 30-m transect showing the barbed wire property fence.

Site SW020 was wadeable for the entire 300-m reach length. Average thalweg was 0.29 m during both surveys (Table 5.6). During each survey, the sandy substrate and shallow water depths made wading in the stream channel easy except for the occasional occurrences of dense vegetation. Widths of the stream ranged from a maximum of 14 m to a minimum of 0.50 m both encountered during the second survey (Tables 5.7 and 5.8). The only obstructions encountered were periodic areas of thick vegetation encountered during both surveys.

Aesthetic appearance of the water and wildlife observations for the site during each survey have been previously provided in Tables 5.9 and 5.10, respectively. There was a slight presence of snakes and one beaver observed during the first survey with no other mammals or vertebrates encountered. During the second survey, there was a moderate presence of cattle with no other mammals or vertebrates observed. Tracks found during both surveys were identified as cattle and raccoon. Bird and cattle feces were found throughout the reach during both surveys. Aquatic vegetation was abundant during the both surveys, while algae was abundant during the first survey and absent during the second survey. Water color was clear during both surveys. Surface scum

and foam was only encountered during the second survey. Trash consisting of typical plastics was only encountered during the first survey and occurrence was rare. There was no evidence of human recreational activity was observed during either survey.



Figure 5.50 Photograph of Sweetwater Creek Site SW020 taken on July 29, 2013, the upstream view of the 150-m transect.

Physical Description of SW021

Sweetwater Creek at site SW021 was visited on May 27 and July 28, 2013. This site, located northwest of Wheeler, Texas in Wheeler County, was accessible through private land that was fenced with a cattle guard and potentially locked gate (Bing maps shows the private property road as County Road 13, but the road is mislabeled and is a private road). With landowner permission, TIAER personnel drove over the cattle guard and through additional interior gates approximately one mile on the pasture road to reach the site. The site is located in a grass and forb dominated corridor with a few trees along the bank and pasture land beyond (Table 5.5). At the site, access to the stream was easy due to the low banks (Table 5.6). Figures 5.51 and 5.52 depict the appearance of the site during each of the surveys.



Figure 5.51 Photograph of Sweetwater Creek Site SW021 taken on May 27, 2013, the downstream view of the 300-m transect.



Figure 5.52 Photograph of Sweetwater Creek Site SW021 taken on July 28, 2013, the upstream view of the 150-m transect.

Site SW021 was wadeable for the entire 300-m reach length. Average thalweg was 0.22 m during the first survey and 0.02 m during the second survey (Table 5.6). During each survey, the sandy substrate and shallow water depths made wading in the stream channel easy. Widths of the stream ranged from a maximum of 11 m during the first survey to a minimum of 0.0 m encountered during the second survey when the stream was not flowing (Tables 5.7 and 5.8). There was one pocket of water found at the 300-m transect during the second survey but was not identified as a pool with a maximum depth of 0.2 meters.

Aesthetic appearance of the water and wildlife observations for the site during each survey have been previously provided in Tables 5.9 and 5.10, respectively. There was a slight presence of turkeys and cattle during the first survey with no other mammals or vertebrates encountered. During the second survey, there was a moderate presence of turkeys and cattle with no other mammals or vertebrates observed. Tracks found during both surveys were identified as cattle, deer, and raccoon. Bird, deer, and cattle feces were found throughout the reach during both surveys. Aquatic vegetation was common during the both surveys, while algae was abundant during the first survey and absent during the second survey, due to the lack of water. Water color was clear during both surveys with no surface scum and foam observed. Trash was not observed during either survey, and there was no evidence of human activity.

Physical Description of SW022

Sweetwater Creek at site SW022 was visited on May 28 and July 28, 2013. This site, located northwest of Wheeler, Texas in Wheeler County, was accessible through private land that was fenced with a cattle guard and potentially locked gate. With landowner permission, TIAER personnel drove over the cattle guard and through additional interior gates approximately three-quarter mile on the gravel and pasture road to reach the site. The site is located in a grass and forb dominated corridor with a few trees along the bank and pasture land beyond (Table 5.5). At the site, access to the stream was easy due to the low to gently sloping banks (Table 5.6). Figures 5.53 and 5.54 depict the appearance of the site during each of the surveys.

Site SW022 was wadeable for the entire 300-m reach length. Average thalweg was 0.18 m during the first survey and 0.0 m during the second survey when no water was present (Table 5.6). During each survey, the sandy substrate and shallow to nonexistent water depths made walking in the stream channel easy. Widths of the stream ranged from a maximum of 11 m during the first survey to a minimum of 0.0 m during the second survey when the stream was not flowing (Tables 5.7 and 5.8). There was a pasture road crossing at the 0-m transect with no obstructions encountered during either survey.



Figure 5.53 Photograph of Sweetwater Creek Site SW022 taken on May 28, 2013, the upstream view of the 150-m transect.



Figure 5.54 Photograph of Sweetwater Creek Site SW022 taken on July 28, 2013, the downstream view of the 300-m transect.

Aesthetic appearance of the water and wildlife observations for the site during each survey have been previously provided in Tables 5.9 and 5.10, respectively. There was a slight presence of deer and cattle during the first survey with no other mammals or vertebrates encountered. During the second survey, there was a moderate presence cattle with no other mammals or vertebrates observed. Tracks found during both surveys were identified as cattle, deer, canine, bird, and raccoon. Bird and cattle feces were found throughout the reach during both surveys. Aquatic vegetation was abundant during the first survey and common during the second survey. Algae was abundant during the first survey and absent during the second survey, due to the lack of water. Water color was clear with no surface scum and foam observed during the first survey when water was present. Trash was not observed during either survey, and there was no evidence of human activity.

Physical Description of SW023

Sweetwater Creek at site SW023 was visited on May 28 and July 28, 2013. This site, located northwest of Wheeler, Texas in Wheeler County, was accessible through private land that was fenced. With landowner permission, TIAER personnel drove approximately one-quarter mile down a gravel private road to the landowner's house. After traveling through a gate behind the landowner's house, field crew members drove approximately one-quarter mile through a pasture to reach the site. The site is located in a grass and forb dominated corridor with a few shrubs along the bank and pasture land beyond (Table 5.5). Access to the stream was moderately easy due to thick vegetation throughout the reach. Although the banks were relatively low, dense vegetation made efforts to gain access to the stream challenging except for a few locations (Table 5.6). Figures 5.55 and 5.56 depict the appearance of the site during each of the surveys.

Site SW023 was wadeable for the entire 300-m reach length. Average thalweg was 0.35 m during the first survey and 0.20 m during the second survey (Table 5.6). During each survey, the dense vegetation made walking in the stream channel very challenging despite the shallow water depths. TIAER personnel would typically walk along the bank and forge a path through the vegetation at each transect to obtain depth measurements and photographic documentation of the conditions. Widths of the stream ranged from a maximum of 12 m during the first survey to a minimum of 0.0 m during the second survey when the stream was not flowing (Tables 5.7 and 5.8). There was a pasture road crossing at the 150-m transect which served as the maximum width location. The only obstructions along the reach were thick vegetation during both surveys.

Aesthetic appearance of the water and wildlife observations for the site during each survey have been previously provided in Tables 5.9 and 5.10, respectively. There was a slight presence of snakes during both surveys. During the first survey in May, the landowner's dog accompanied TIAER personnel to the creek which was documented as a slight presence of domestic pets. During the second survey, there was a moderate presence of deer upon arrival at the site. No other mammals or vertebrates were encountered during either survey. Tracks found during both surveys were identified as cattle, deer, and canine. Bird and cattle feces were found throughout the reach during both surveys. Aquatic vegetation was abundant and algae was rare during both surveys. Water color was clear with no surface scum and foam observed during either survey. Trash was not observed during either survey and there was no evidence of human activity.



Figure 5.55 Photograph of Sweetwater Creek Site SW023 taken on May 28, 2013, the downstream view of the 300-m transect. TIAER personnel in photograph.



Figure 5.56 Photograph of Sweetwater Creek Site SW023 taken on July 28, 2013, the upstream view of the 30-m transect.

Physical Description of SW024

Sweetwater Creek at site SW024 was visited on May 26 and July 28, 2013. This site, located northwest of Wheeler, Texas in Wheeler County, was accessible through private land that was fenced. With landowner permission, TIAER personnel stepped over an electric fence and used the fence line as the 0-m transect. The site is listed as being publicly accessible, but public access is limited to the areas approximately 20 meters upstream and downstream of the bridge crossing Ranch Road 3182. The site is located in a grass and forb dominated corridor with a few shrubs along the bank and pasture land beyond (Table 5.5). At the site, access to the stream was easy despite vegetation throughout the reach. Although the banks were relatively low for easy access to the stream, the vegetation made efforts to traverse the stream challenging except for a few locations (Table 5.6). Figures 5.57 and 5.58 depict the appearance of the site during each of the surveys.



Figure 5.57 Photograph of Sweetwater Creek Site SW024 taken on May 26, 2013, the upstream view of the 30-m transect.

Site SW024 was wadeable for the entire 300-m reach length, although it was challenging. There was a beaver dam with a hut on the downstream side of the bridge crossing Ranch Road 3182 and water was backed up for a large distance upstream (Figure 5.59). The study reach was determined to be one large pool greater than 300 meters long with a maximum depth greater than 1.4 meters and a maximum width of 14 meters during the first survey. During the second survey, the maximum width was 13 meters with a maximum depth of 1.1 meters. Average thalweg was >1.0 m during the first survey and 0.70 m during the second survey (Table 5.6).



Figure 5.58 Photograph of Sweetwater Creek Site SW024 taken on July 28, 2013, the upstream view of the 150-m transect.



Figure 5.59 Photograph of Sweetwater Creek Site SW024 taken on May 26, 2013 showing the beaver hut located on the downstream side of the bridge crossing Ranch Road 3182.

During each survey, the dense vegetation made walking in the stream channel very challenging. The mud/clay substrate with sludge bottom deposits added to the difficulty in traversing the stream. TIAER personnel would typically walk along the bank and forge a path through the vegetation at each transect to obtain depth measurements and photographic documentation of the conditions. Widths of the stream ranged from a maximum of 14 m during the first survey to a minimum of 1.2 m during the second survey (Tables 5.7 and 5.8). The only obstructions throughout the reach during both surveys were the thick vegetation and the beaver dam located outside of the study reach.

Aesthetic appearance of the water and wildlife observations for the site during each survey have been previously provided in Tables 5.9 and 5.10, respectively. There were no mammals or vertebrates encountered during either survey. Tracks found during both surveys were identified as cattle and deer. Bird, canine, and cattle feces were found throughout the reach during both surveys. Aquatic vegetation was abundant during both surveys, while algae was common during the first survey and rare during the second survey. Water color was clear with no surface scum and foam observed during either survey. Trash was not observed during either survey, and there was no evidence of human activity.

Physical Description of SW025

Sweetwater Creek at site SW025 was visited on May 28 and July 28, 2013. This site, located east of Mobeetie, Texas in Wheeler County, was accessible through private land that was fenced with a cattle guard and potentially locked gate. With landowner permission, TIAER personnel drove over the cattle guard and through several interior gates approximately one mile to reach the site. The site is located in a grass and forb dominated corridor with a few shrubs along the bank and pasture land beyond (Table 5.5). At the site, access to the stream was moderately easy due to thick vegetation throughout the reach and occasional steep banks. The vegetation and sometimes dense shrubs made efforts to gain access to the stream challenging except for a few locations (Table 5.6). Figures 5.60 and 5.61 depict the appearance of the site during each of the surveys.

Site SW025 was wadeable for the entire 300-m reach length, although it was challenging. Average thalweg was 0.28 m during the first survey and 0.06 m during the second survey (Table 5.6). During each survey, the dense vegetation made walking in the stream channel very challenging. The mud/clay substrate with sludge bottom deposits added to the difficulty in traversing the stream. TIAER personnel would typically walk along the bank and forge a path through the vegetation at each transect to obtain depth measurements and photographic documentation of the conditions. Widths of the stream ranged from a maximum of 5.2 m during the first survey to a minimum of 0.0 m during the second survey when the stream was not flowing and only had pockets of water near the upper end of the reach (Tables 5.7 and 5.8). Thick vegetation was the only obstruction encountered throughout the reach during both surveys.



Figure 5.60 Photograph of Sweetwater Creek Site SW025 taken on May 28, 2013, the upstream view of the 150-m transect.



Figure 5.61 Photograph of Sweetwater Creek Site SW025 taken on July 28, 2013, the upstream view of the 30-m transect.

Aesthetic appearance of the water and wildlife observations for the site during each survey have been previously provided in Tables 5.9 and 5.10, respectively. There was a slight presence of water dependent birds and wildlife, ground squirrels and deer, observed during the first survey. There were no other mammals or vertebrates encountered during the first survey. No animals or vertebrates were encountered during the second survey. Tracks found during both surveys were identified as cattle, raccoon, and deer. Bird and cattle feces were found throughout the reach during both surveys. Aquatic vegetation was abundant during both surveys, while algae was rare during the first survey and absent during the second survey when most of the stream was dry. Water color was clear with no surface scum and foam observed during either survey. Trash, observed only during the first survey, consisted of two tires and one metal post. No evidence of human recreational activity was observed.

Physical Description of SW026

Sweetwater Creek at site SW026 was visited on May 27 and July 28, 2013. This site, located southeast of Mobeetie, Texas in Wheeler County, was accessible through private land that was fenced. The site is listed as being publicly accessible but property fences underneath the bridge crossing State Highway 152 limit public access (Figure 5.62). With landowner permission, TIAER personnel stepped over the fence and established the 0-m transect at the bridge crossing and worked upstream. The site is located in a grass and forb dominated corridor with a few shrubs along the bank and pastureland beyond (Table 5.5). At the site, access to the stream was moderately easy due to thick vegetation throughout the reach and occasional steep banks. The vegetation and sometimes dense shrubs made efforts to gain access to the stream challenging except for a few locations (Table 5.6). Figures 5.63 and 5.64 depict the appearance of the site during each of the surveys.

Site SW026 was wadeable for the entire 300-m reach length, although it was challenging due to some deep pools created by beaver dams (Figure 5.64). TIAER personnel carefully waded the edges of the pools to avoid filling their waders. The two pools were observed during both of the surveys in the same locations, between the 180-m and 210-m transects for the first pool and from the 280-m transect to beyond the 300-m transect. The length of the first pool ranged from 25 to 30 meters, with widths of approximately 10 meters and depths over 1.5 meters. The second pool was greater than 50 meters long, as it went well beyond the 300-m transect. Widths of the second pool ranged from 7.5 to 9.0 meters wide with depths also over 1.5 meters. Average thalweg was >0.56 m during the first survey and >0.54 m during the second survey (Table 5.6).

During each survey, the dense vegetation made walking in the stream channel very challenging. The mud/clay substrate with sludge bottom deposits added to the difficulty in traversing the stream. TIAER personnel would typically walk along the bank and forge a path through the vegetation at each transect to obtain depth measurements and photographic documentation of the conditions. Widths of the stream ranged from a maximum of 19 m during the second survey to a minimum of 0.50 m during the first survey (Tables 5.7 and 5.8). Thick vegetation and one log jam were the only obstructions encountered throughout the reach during both surveys.



Figure 5.62 Photograph of Sweetwater Creek Site SW026 taken on July 28, 2013 showing the property fences underneath the bridge crossing State Highway 152.



Figure 5.63 Photograph of Sweetwater Creek Site SW026 taken on May 27, 2013, the upstream view of the 150-m transect.



Figure 5.64 Photograph of Sweetwater Creek Site SW026 taken on July 28, 2013, the upstream view of the 300-m transect.

Aesthetic appearance of the water and wildlife observations for the site during each survey have been previously provided in Tables 5.9 and 5.10, respectively. There was a slight presence of snakes during the first survey with no other mammals or vertebrates observed. No animals or vertebrates were encountered during the second survey. Tracks found during both surveys were identified as cattle, raccoon, canine, and deer. Bird and cattle feces were found throughout the reach during both surveys. Aquatic vegetation was abundant during both surveys while algae was common during the first survey and rare during the second survey. Water color was clear with no surface scum and foam observed during either survey. During the second survey, there was an odor to the water, which may have been caused by TIAER personnel disturbing the sludge deposits on the bottom of the stream. Trash, rarely observed during the both surveys, consisted of typical plastics and aluminum cans. The only evidence of human activity within the reach was a minnow trap and a fishing lure, both found on the bank of the stream (Figures 5.65 and 5.66).



Figure 5.65 Photograph of minnow trap at Site SW026 taken on May 27, 2013.



Figure 5.66 Photograph of fishing lure at Site SW026 taken on May 27, 2013.

Physical Description of SW027

Sweetwater Creek at site SW027 was visited on May 28 and July 28, 2013. This site, located southeast of Mobeetie, Texas in Wheeler County, was accessible through private land that was fenced with a cattle guard and potentially locked gate. With landowner permission, TIAER personnel drove over the cattle guard approximately three-quarter mile on a gravel road to reach the site. The site is located in a grass dominated corridor with a few trees along the gently sloping banks and pasture land beyond (Table 5.5). At the site, access to the stream was easy with low banks and a private road crossing at the 0-m transect (Table 5.6). Figures 5.67 and 5.68 depict the appearance of the site during each of the surveys.



Figure 5.67 Photograph of Sweetwater Creek Site SW027 taken on May 28, 2013, the upstream view of the 30-m transect.

Site SW027 was wadeable for the entire 300-m reach length, although thick vegetation made traversing the stream channel challenging (Figures 5.67 and 5.68). One pool was identified during the first survey that was 30 meters long, 11 meters wide and had a maximum depth of 1.6 meters. Average thalweg was 0.18 m during the first survey and 0.08 m during the second survey (Table 5.6). During both surveys, the vegetation and sludge bottom deposits made walking in the stream channel challenging despite the sand dominant substrate. TIAER personnel would typically walk along the bank and forge a path through the vegetation at each transect to obtain depth measurements and photographic documentation of conditions. Widths of the stream ranged from a maximum of 20 m to a minimum of 1.4 m both encountered during the second survey (Tables 5.7 and 5.8). Thick vegetation and one log jam were the only obstructions encountered throughout the reach during both surveys.



Figure 5.68 Photograph of Sweetwater Creek Site SW027 taken on July 28, 2013, the downstream view of the 300-m transect.

Aesthetic appearance of the water and wildlife observations for the site during each survey have been previously provided in Tables 5.9 and 5.10, respectively. There was a slight presence of snakes encountered during the second survey. There were no other mammals or vertebrates were encountered during the either survey. Tracks found during both surveys were identified as cattle and deer. Bird and cattle feces were found throughout the reach during both surveys. Aquatic vegetation was abundant during both surveys, while algae was common during both surveys. Water color was clear with no surface scum and foam observed during either survey. Trash, rarely observed during the both surveys, consisted of typical plastics, aluminum cans and a piece of tin. No evidence of recreational human activity was observed within the reach.

Physical Description of SW028

Sweetwater Creek at site SW028 was visited on May 28 and July 28, 2013. This site, located south of Mobeetie, Texas in Wheeler County, was accessible through private land that was fenced. With landowner permission, TIAER personnel drove approximately one-half mile on a pasture road to reach the site. The site is located in a grass and forb dominated corridor with a few shrubs along the bank and pasture land beyond (Table 5.5). At the site, access to the stream was moderately easy due to dense vegetation (Table 5.6). Figures 5.69 and 5.70 depict the appearance of the site during each of the surveys.



Figure 5.69 Photograph of Sweetwater Creek Site SW028 taken on May 28, 2013, the downstream view of the 150-m transect.



Figure 5.70 Photograph of Sweetwater Creek Site SW028 taken on July 28, 2013, the downstream view of the 30-m transect. TIAER truck in photograph.

Site SW028 was wadeable for the entire 300-m reach length, although thick vegetation made traversing the stream channel challenging (Figure 5.99 and 5.70). No pools were identified during either survey. Average thalweg was 0.33 m during the first survey and 0.19 m during the second survey (Table 5.6). During both surveys, the vegetation and sludge bottom deposits made walking in the stream channel challenging despite the sand dominant substrate. TIAER personnel would typically walk along the bank and forge a path through the vegetation at each transect to obtain depth measurements and photographic documentation of the conditions. Widths of the stream ranged from a maximum of 14 m during the first survey to a minimum of 0.0 m during the second survey when the stream was not flowing (Tables 5.7 and 5.8). Thick vegetation was the only obstruction encountered throughout the reach during both surveys.

Aesthetic appearance of the water and wildlife observations for the site during each survey have been previously provided in Tables 5.9 and 5.10, respectively. There was a slight presence of deer with no other mammals or vertebrates were encountered during both surveys. Tracks found during both surveys were identified as cattle, raccoon, and deer. Bird and cattle feces were found throughout the reach during both surveys. Aquatic vegetation was abundant during both surveys, while algae was common during the first survey and absent during the second survey when there was significantly less water. Water color was clear with no surface scum and foam observed during either survey. No trash or evidence of human activity was observed during either survey within the reach.

Physical Description of SW029

Sweetwater Creek at site SW029 was visited on May 27 and July 28, 2013. This site, located northwest of Mobeetie, Texas in Wheeler County, was accessible through private land that was fenced. With landowner permission, TIAER personnel parked along the county road and stepped through the property fence to conduct the survey. The road crossing served as the 300-m transect and TIAER personnel worked downstream from the road. Although the site is listed as being publicly accessible, public access is limited to an area approximately eight feet up and downstream of the culvert crossing to the property fence (Figure 5.71). The site is located in a shrub and tree dominated corridor with pasture land beyond (Table 5.5). At the site, access to the stream was moderately easy due to the property fence and tall banks within the study reach (Table 5.6). Figures 5.72 and 5.73 depict the appearance of the site during each of the surveys.

Site SW029 was wadeable for the entire 300-m reach length. Although water was present in pockets throughout the reach, no pools were identified during either survey with maximum water depths of only 0.25 meters. Average thalweg was 0.03 m during the first survey and 0.0 m during the second survey (Table 5.6). During both surveys, the sand dominant substrate made traversing the stream channel easy. Widths of the stream ranged from a maximum of 4.5 m during the first survey to a minimum of 0.0 m during the second survey (Tables 5.7 and 5.8). The stream was not flowing during either survey. One tree obstruction was encountered within the reach during both surveys.



Figure 5.71 Photograph of Sweetwater Creek Site SW029 taken on July 28, 2013 showing public accessibility at the road. TIAER truck and personnel in photograph.



Figure 5.72 Photograph of Sweetwater Creek Site SW029 taken on May 27, 2013, the upstream view of the 150-m transect.



Figure 5.73 Photograph of Sweetwater Creek Site SW029 taken on July 28, 2013, the downstream view of the 300-m transect.

Aesthetic appearance of the water and wildlife observations for the site during each survey have been previously provided in Tables 5.9 and 5.10, respectively. There were no mammals or vertebrates encountered during either survey. Tracks found during both surveys were identified as cattle, raccoon, feline and deer. Bird, deer, canine, and cattle feces were found throughout the reach during both surveys. Aquatic vegetation was rare during both surveys, while algae was rare during the first survey and absent during the second survey. Water color, when water was present, was clear during the first survey and brown during the second survey with no surface scum or foam observed during either survey. Trash, which was rare, was primarily found near the road crossing and consisted of glass bottles, typical plastics, and aluminum cans. No evidence of human recreational activity was observed within the reach during either survey.

Physical Description of SW030

Sweetwater Creek at site SW030 was visited on May 27 and July 28, 2013. This site, located northwest of Mobeetie, Texas in Wheeler County, was accessible through private land that was fenced. With landowner permission, TIAER personnel parked along the county road and stepped through the property fence to conduct the survey. The road crossing served as the 0-m transect and TIAER personnel worked upstream from the road. Although the site is listed as being publicly accessible, public access is limited to an area approximately eight feet up and downstream of the culvert crossing to the property fence (Figure 5.74).



Figure 5.74 Photograph of Sweetwater Creek Site SW030 taken on July 28, 2013 showing public accessibility at the road.

The site is located in a grass and forb dominated corridor with a few shrubs and pasture land beyond (Table 5.5). At the site, access to the stream was moderately easy due to the property fence and tall banks within the study reach (Table 5.6). Figures 5.75 and 5.76 depict the appearance of the site during each of the surveys.

Site SW030 was wadeable for the entire 300-m reach length. No pools were identified during either survey. With no water encountered, the average thalweg for both surveys was 0.0 m (Table 5.6). During both surveys, the sand dominant substrate made traversing the stream channel easy. Maximum and minimum widths of the stream were 0.0 m since the stream was dry (Tables 5.7 and 5.8). The only obstructions encountered throughout the reach were the property fence and the culvert bridge crossing on County Road 2.

Aesthetic appearance of the water and wildlife observations for the site during each survey have been previously provided in Tables 5.9 and 5.10, respectively. There were no mammals or vertebrates encountered during the first survey. There was a moderate presence of cattle and one turtle encountered during the second survey. Tracks found during both surveys were identified as cattle, raccoon, and deer. Cattle feces were found throughout the reach during both surveys. Aquatic vegetation and algae was absent during both surveys. There was no water encountered during either survey. Trash, which was rare, was primarily found near the road crossing and consisted of glass bottles, typical plastics, and a feed sack.



Figure 5.75 Photograph of Sweetwater Creek Site SW030 taken on May 27, 2013, the upstream view of the 300-m transect.



Figure 5.76 Photograph of Sweetwater Creek Site SW030 taken on July 28, 2013, the upstream view of the 150-m transect.

Physical Description of SW031

Sweetwater Creek at site SW031 was visited on May 27 and July 28, 2013. This site, located northwest of Mobeetie, Texas in Gray County, was accessible through private land that was fenced with a cattle guard and potentially locked gate. With landowner permission, TIAER personnel drove approximately two miles on a gravel and pasture road to reach the site. The site is located in a grass dominated corridor with a few shrubs and trees with native pasture land beyond (Table 5.5). At the site, access to the stream was moderately easy due to tall steep banks within the study reach (Table 5.6). Figures 5.77 and 5.78 depict the appearance of the site during each of the surveys.



Figure 5.77 Photograph of Sweetwater Creek Site SW031 taken on May 27, 2013, the upstream view of the 300-m transect.

Site SW031 was wadeable for the entire 300-m reach length, although no water was encountered during either survey. No obstructions were encountered within the reach. During both surveys, the sand dominant substrate made traversing the stream channel easy. No pools were identified during either survey. Average thalweg for both surveys was 0.0 m (Table 5.6). Maximum and minimum widths of the stream were 0.0 m since the stream was dry (Tables 5.7 and 5.8).



Figure 5.78 Photograph of Sweetwater Creek Site SW031 taken on July 28, 2013, the upstream view of the 30-m transect.

Aesthetic appearance of the water and wildlife observations for the site during each survey have been previously provided in Tables 5.9 and 5.10, respectively. There were no mammals or vertebrates encountered during either survey. Tracks found during both surveys were identified as canine and deer. Bird and deer feces were found throughout the reach during both surveys.

Trash, which was rare, consisted of random pieces of metal including one metal drum. Evidence of human activity was found in the form of 4-wheeler tracks on the bank of the stream and one set of boot prints in the stream channel found during the second survey. This evidence is not believed to be from water recreational activities but probably associated with hunting or dam construction work on one of the tributaries leading to the stream. One picnic area was observed on the property between Sites SW031 and SW032 (Figure 5.79). According to the landowner, this is a family picnic area primarily used during hunting season, but his family has also used it immediately after a storm for wading purposes by his kids.



Figure 5.79 Photograph of picnic area between Sites SW031 and SW032 taken on July 28, 2013.

Physical Description of SW032

Sweetwater Creek at site SW032 was visited on May 27 and July 28, 2013. This site, located northwest of Mobeetie, Texas in Gray County, was accessible through private land that was fenced with a cattle guard and potentially locked gate. With landowner permission, TIAER personnel drove approximately one and one-quarter miles on a gravel and pasture road to reach the site. The site is located in a grass dominated corridor with a few shrubs and trees with native pasture land beyond (Table 5.5). At the site, access to the stream was easy due to a road crossing at the 0-m transect and the gently sloping banks within the study reach (Table 5.6). Figures 5.80 and 5.81 depict the appearance of the site during each of the surveys.

Site SW031 was dry for the entire 300-m reach length as no water was encountered during either survey. During both surveys, the sand dominant substrate made traversing the stream channel easy. No pools were identified during either survey. Average thalweg for both surveys was 0.0 m (Table 5.6). Maximum and minimum widths of the stream were 0.0 m since the stream was dry (Tables 5.7 and 5.8). Tree and dense vegetation obstructions were encountered within the reach during both surveys.



Figure 5.80 Photograph of Sweetwater Creek Site SW032 taken on May 27, 2013, the upstream view of the 300-m transect.



Figure 5.81 Photograph of Sweetwater Creek Site SW032 taken on July 28, 2013, the downstream view of the 150-m transect.

Aesthetic appearance of the water and wildlife observations for the site during each survey have been previously provided in Tables 5.9 and 5.10, respectively. There was a slight presence of turkeys during the first survey. There were no other mammals or vertebrates encountered during either survey. Tracks found during both surveys were identified as canine, cattle, and deer. Bird, canine, and deer feces were found throughout the reach during both surveys. Trash, which was rare, consisted of one metal drum. There was no evidence of human activity was found within the study reach. As previously mentioned, a picnic area was observed on the property between Sites SW031 and SW032.

Physical Description of SW033

Sweetwater Creek at site SW033 was visited on May 27 and July 28, 2013. This site, located northwest of Mobeetie, Texas in Gray County, was accessible through private land that was fenced. With landowner permission, TIAER personnel parked along the county road and stepped through the property fence to conduct the survey. The road crossing served as the 0-m transect and TIAER personnel worked upstream from the road. Although the site is listed as being publicly accessible, public access is limited to an area approximately eight feet up and downstream of the culvert crossing to the property fence (Figure 5.82). The site is located in a grass dominated corridor with pasture land beyond (Table 5.5). At the site, access to the stream was easy once through the property fence (Table 5.6). Figures 5.83 and 5.84 depict the appearance of the site during each of the surveys.



Figure 5.82 Photograph of the road crossing on County Road B (Hoffer Road) at Site SW033 taken on July 28, 2013 showing limited public accessibility.



Figure 5.83 Photograph of Sweetwater Creek Site SW033 taken on May 27, 2013, the upstream view of the 150-m transect.



Figure 5.84 Photograph of Sweetwater Creek Site SW033 taken on July 28, 2013, the downstream view of the 30-m transect.

Site SW031 was wadeable for the entire 300-m reach length. No pools were identified during either survey, although pockets of water were encountered during the second survey. Average thalweg was 0.0 for the first survey and 0.02 m during the second survey (Table 5.6). During the first survey, the dry mud/clay dominant substrate made traversing the stream channel easy. During the second survey, the wet mud/clay made wading challenging, but TIAER personnel would walk along the banks of the stream and take measurements and photographs at each appropriate transect. Maximum width of the stream was 3.4 m during the second survey and 0 m during the first survey. The minimum width was 0.0 m encountered during both surveys (Tables 5.7 and 5.8). The only obstructions encountered during both surveys were the property fence and the culvert road crossing. The stream was not flowing during either survey.

Aesthetic appearance of the water and wildlife observations for the site during each survey have been previously provided in Tables 5.9 and 5.10, respectively. There were no mammals or vertebrates encountered during either survey. Tracks found during both surveys were identified as cattle and deer. Bird and cattle feces were found throughout the reach during both surveys. Aquatic vegetation and algae were absent during both surveys. Water color during the second survey was clear and brown with no scum or foam observed. Trash was not encountered during either survey. There was no evidence of human recreational activity identified.

Observations and Interviews

Activities Observed

During each RUAA survey, field personnel visited the sites during times of days and on days when recreational activities were apt to be observed. Ten of the thirty-three selected sites were at locations that provided public access, albeit limited public access. All of the publicly accessible sites were located at public road crossings, however, property fences limited access to small areas between the road and the fence. Private fences at some locations went right up to the bridge at the road crossing to a distance of about 20 meters up and downstream of the bridge crossings. The remaining twenty-three sites were located on private property and TIAER personnel were granted permission from the landowners to conduct the RUAA at these locations.

No contact (primary or secondary) or noncontact recreational activities were observed by TIAER employees at any of the sites during the field surveys. Evidence of possible recreation was encountered at five sites throughout the reach and one area between sites owned by the same landowner.

ATV tracks and a fishing bobber hanging in a tree branch were observed at the private road crossing at Site SW003. The fishing bobber is believed to have washed in from upstream. The ATV tracks were limited to the area immediately downstream of the road crossing where the water was shallow, and the ATV appeared to have turned around in the stream.

At Site SW009, the area immediately underneath the bridge appears to be a popular “hang out” spot based on the alcoholic and non-alcoholic beverage containers in one general area.

Two minnow traps with ropes attached leading up the steep bank were encountered at Site SW011. Based on information from the landowner, these belong to the landowner's son and are used to catch bait for fishing on private tanks.

One minnow trap and fishing lure were found at Site SW026. They were found at the large pool near the 300-m transect.

Based on a conversation with the landowner, ATV tracks encountered along the bank at Site SW031 are associated with hunting or just recreational driving through the pasture, not any form of water recreation. The boot prints were in an area of the stream adjacent to a dam, which had been constructed on a tributary of the stream. The work had been done recently and was probably associated with the dam construction. One picnic area was found between Sites SW031 and SW032 on private property. According to the landowner, he and his family utilize this location during hunting season and also times immediately after storm events for his children to wade in the stream.

Activities Interviewed

Interviews were conducted from landowners along Sweetwater Creek as well as other persons of interest. A total of seventeen interviews were collected. Primary contact recreational activities were identified from the interviews. As shown in Table 5.11, there were several instances of recreation noted as occurring along Sweetwater Creek.

The landowner of Sites SW008 and SW009 stated that no recreation occurs in the stream on their property.

The landowner of Sites SW010 and SW011 stated that no recreation occurs in the stream on their property. She stated that the only times that there is water in the creek is spring and fall. Most of the time there is insufficient water. When informed of the two minnow traps observed in the stream on her property, she stated that her son would catch bait from the stream to fish in one of the many tanks on their property.

The landowner of Sites SW017, SW018, and SW019 stated that hunting, trapping and wading by adults and children did occur on their property. Hunting happened all throughout the year while trapping only occurred when necessary. The wading typically occurs in the fall, spring and early summer. They reported that they have personally recreated, seen others and heard of others doing the same activities. They further noted that the creek first dried up in 1963 and since that time, the creek dries up during the summer months.

The landowner of Site SW023 reported swimming, wading by adults and children, hunting and fishing as the recreational activities their family had performed on the stream. These activities occurred in the summer and winter in the stream they state was perennial up until two years ago. A spring on their property keeps the stream flowing except during the hottest, driest months. They additionally reported observing others fishing at the bridge crossing on Ranch Road 3182, Site SW024, during the spring and summer.

Table 5.11 Summary of recreational activities noted in interviews for Sweetwater Creek.

Activities are listed as the number of times personal use, observed use, or heard of use was documented from interviews for a given location or the whole assessment unit. Blank cells indicate no interviewed feedback for that location. An * indicates recreation at multiple sites from one interview form. No recreational activities were observed during field surveys or site visits.

Site Name	Swimming	Adult Wading	Children Wading	Hunt	Fish	Boat , Canoe, Kayak
SW001						
SW002						
SW003						
SW004						
SW005						
SW006						
SW007						
SW008	0,0,0	0,0,0	0,0,0	0,0,0	0,0,0	0,0,0
SW009						
SW010	0,0,0	0,0,0	0,0,0	0,0,0	0,0,0	0,0,0
SW011 ^a						
SW012						
SW013						
SW014						
SW015						
SW016						
SW017	0,0,0	1,1,1	1,1,1	1,1,1	0,0,0	0,0,0
SW018		*	*	*		
SW019		*	*	*		
SW020						
SW021						
SW022						
SW023	1,0,0	1,0,0	1,0,0	1,0,0	1,0,0	0,0,0
SW024	0,0,0	0,0,0	0,0,0	0,0,0	1,1,0	0,0,0
SW025						
SW026					0,1,0 ^b	
SW027						
SW028	0,0,0	0,0,0	0,0,0	1,0,0	1,0,0	0,0,0
SW029						
SW030						
SW031	1,0,0	1,0,0	1,0,0	1,0,0	0,0,0	0,0,0
SW032	*	*	*	*		
SW033	0,0,0	0,0,0	0,0,0	0,0,0	0,0,0	0,0,0
General AU	0,1,1	1,2,1	1,2,1	1,1,0	0,1,2	
Totals	2,1,1	4,3,2	4,3,2	5,2,1	3,3,2	0,0,0

- a. The interviewee for Site SW010 also indicated knowledge of Site SW011, but indicated no recreational use direct, seen of or heard of at Site SW011.
- b. The fishing seen at SW026 was reported as part of the interview primarily associated with Site SW028, where the individual actually fished.

The landowner for Site SW024 stated that he infrequently fishes in the pools on his property. The beaver dam located just below the bridge crossing on Ranch Road 3182 has created an ideal fishing hole with depths over 1.0 meter with abundant aquatic vegetation. He further stated that he has heard of other landowners fishing on their properties but has not personally observed this.

The landowner at Site SW028 stated that she hunted on their property year around and also fished, but not very often. She further stated that she had observed persons fishing at the bridge crossing the river at State Highway 152, Site SW026. She did not have knowledge of any other recreational activities along Sweetwater Creek. She claimed that the stream is primarily used for cattle and is not a recreational stream.

The landowner for Sites SW031 and SW032, a game warden, stated that he and his family hunt, swim, and wade in the stream whenever water is present. Over the last ten years, there have been ten times, typically right after a storm event, when there has been sufficient water to recreate. These activities occurred at the picnic area previously discussed between Sites SW031 and SW032. He has never observed other landowners recreating in the stream, but has heard of others recreating the same as his family on their properties.

The landowner for Site SW033 stated that she swam in the stream as a little girl, but that was well before 1974. She stated that she has observed swimming, fishing, and wading by adults and children near the Lancaster place, but not very often. It could not be determined where the Lancaster place was other than near Mobeetie, Texas, so this information was included in the General AU line of Table 5.11.

Another interviewed landowner reported hunting, adult wading and children wading as recreational activities which have utilized the stream near CR 16 in Wheeler. These activities had occurred once or twice yearly on their property, north of the house, since 2004. Additionally, they have observed other non-family members performing the same activities at the same site and frequency. No other types of recreation were reported.

The remaining interviewees all stated to have not personally used, seen others use or heard of others using the stream for any form of recreation.

Summary

RUAA surveys were conducted at thirty-three sites along Sweetwater Creek (AU-0299A) on the days of May 25-29, 2013 and July 28-29, 2013.

During the two surveys, there were no contact recreational activities observed by TIAER field staff. Additionally, there were no non-contact recreational activities observed during either survey. Interviews revealed that swimming, adult wading, children wading, hunting and fishing has occurred at various sites throughout the reach, although not frequently. Areas of the stream open to the public are limited to the right-of-ways immediately underneath bridge crossings or areas immediately up and down stream of culvert crossings, typically ranging from 5 to 20 meters. Recreational activities reported by interviewees are summarized in Figure 5.85. Overall RUAA findings are summarized in the form below.

The Palmer Drought Severity Index (PDSI) represented extreme drought conditions during the first survey in May 2013 and moderate drought conditions during the second survey in July 2013 (TWDB, 2013).

While conducting the stream surveys, no characteristics, such as boat docks, parks, playgrounds, biking trails, campgrounds or sports fields, were encountered that would promote recreation.

The rural nature of the area surrounding Sweetwater Creek is an impediment to recreation. Except for ten sites located at road crossings, all access to Sweetwater Creek is through private property that is fenced, gated and locked. At the public road crossings, access is typically limited to the area immediately underneath the bridge. In most cases, due to vegetation and property fences, access could only be gained directly from the bridge into the stream. Access to most of the stream can only be gained by permission of the landowner. Even then, according to the interviewees, there is typically insufficient water to afford primary contact recreation. In most of the reach, there is no water to allow any form of water recreation.

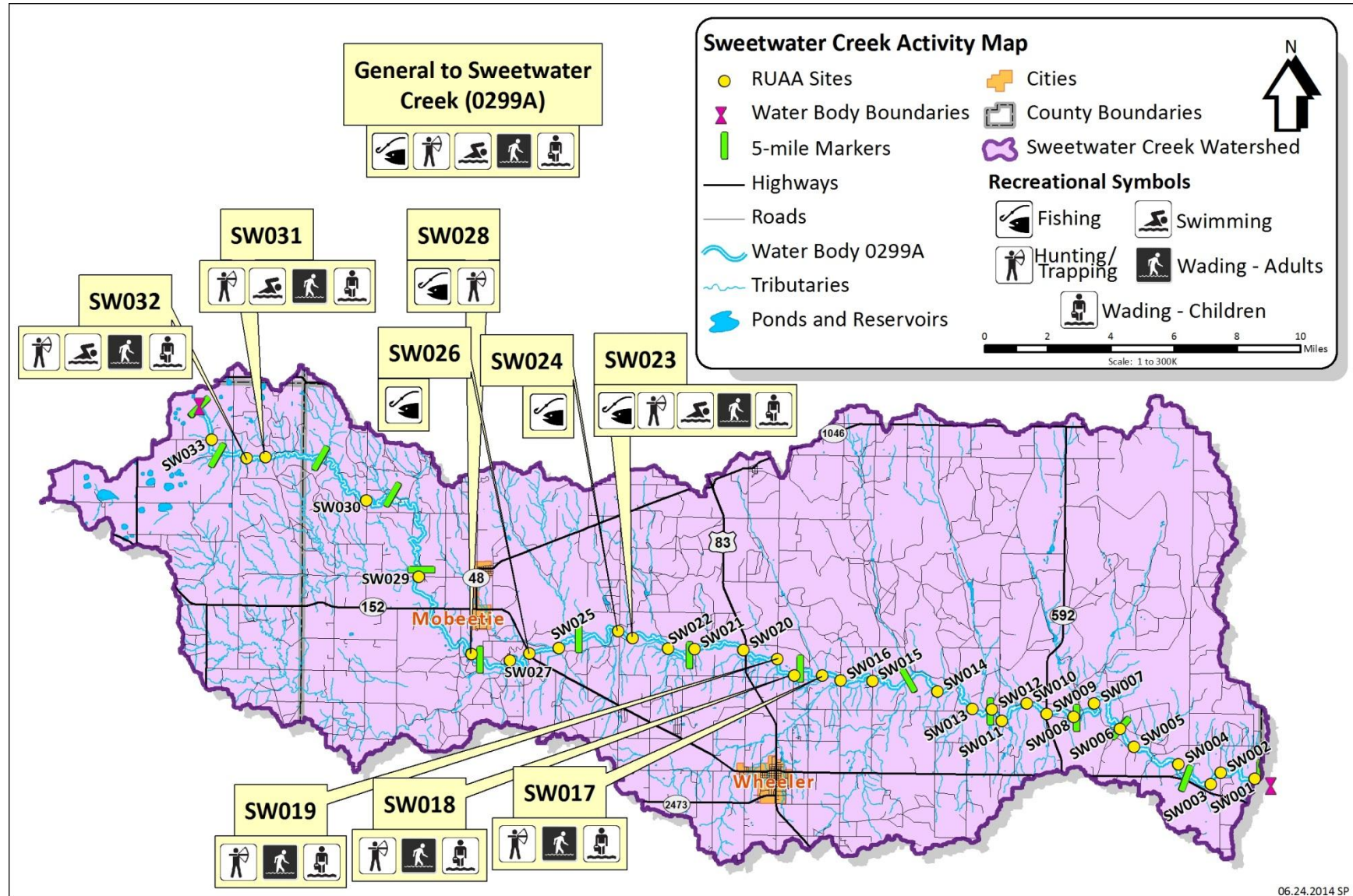


Figure 5.85 Summary of observed and interviewed human activities on Sweetwater Creek.

RUAA Summary
(Not part of the Field Data Sheet)

This form should be filled out after RUAA data collection is completed. Use the Contact Information Form, Field Data Sheets from all sites, Historical Information Review, and other relevant information to answer the following questions on the water body.

Name of water body: Sweetwater Creek

Segment No. of Nearest Downstream Segment No.: Segment 0299

Classified?: No

County: Wheeler and Gray

1. Observations on Use

a. Do primary contact recreation activities occur on the water body?

☐ frequently ☒ seldom ☐ not observed or reported ☐ unknown

b. Do secondary contact recreation 1 activities occur on the water body?

☐ frequently ☒ seldom ☐ not observed or reported ☐ unknown

c. Do secondary contact recreation 2 activities occur on the water body?

☐ frequently ☒ seldom ☐ not observed or reported ☐ unknown

d. Do noncontact recreation activities occur on the water body?

☐ frequently ☐ seldom ☒ not observed or reported ☐ unknown

2. Physical Characteristics of Water Body

a. What is the average thalweg depth? 0.18 meters

b. Are there substantial pools deeper than 1 meter? ☒ Yes ☐ No

c. What is the general level of public access?

☐ easy ☐ moderate ☒ very limited

3. Hydrological Conditions of site visits (Based on Palmer Drought Severity Index)

☒ Mild-Extreme Drought

☐ Incipient dry spell

☐ Near Normal

☐ Incipient wet spell

☐ Mild-Extreme Wet

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